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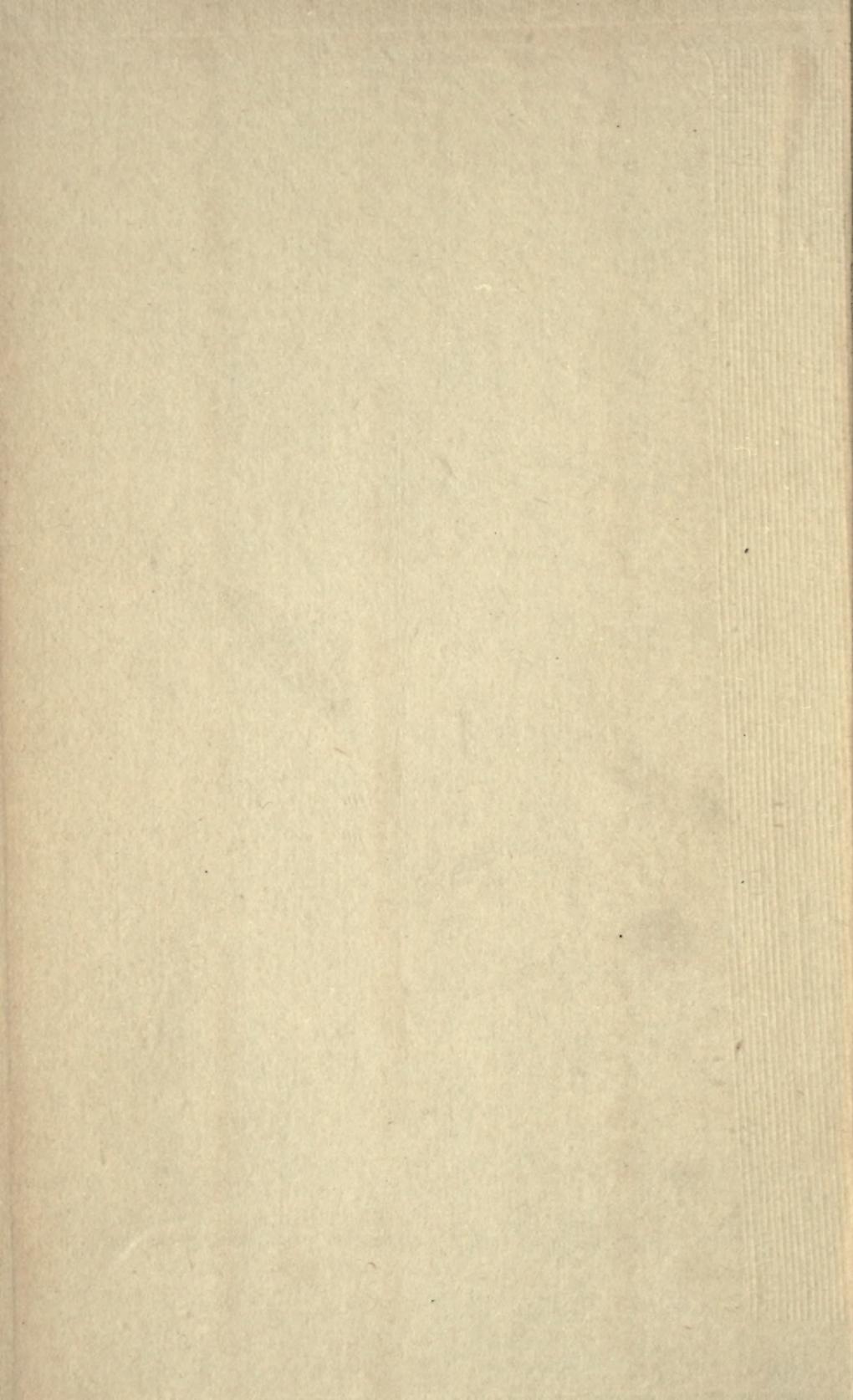
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THAMSTED EXPERIMENTAL STATION
MINISCENCES, TALES & ANECDOTES,

1872-1922

—BY—

EDWIN GREY FIELD SUPT



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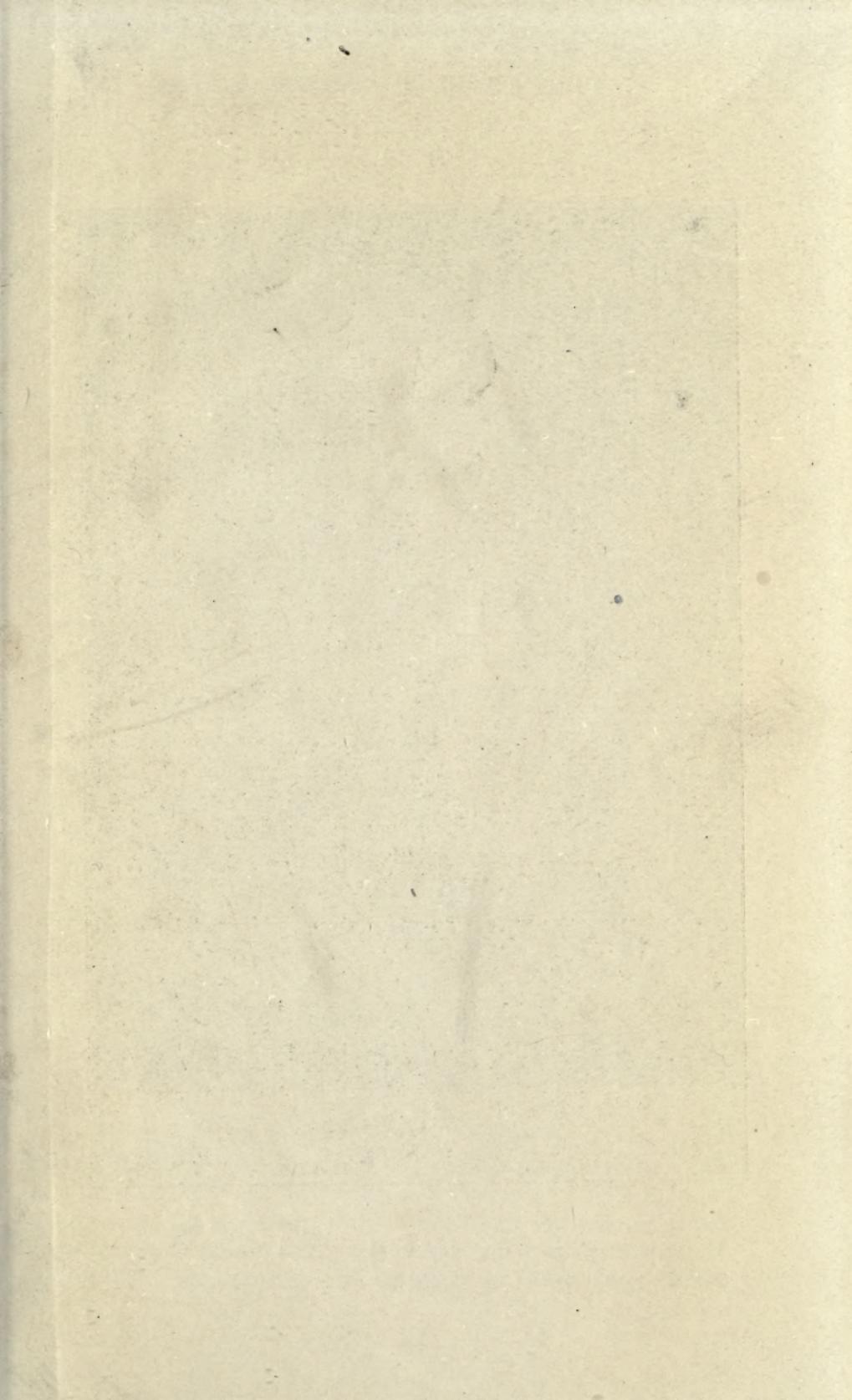
Reminiscences, Tales and Anecdotes

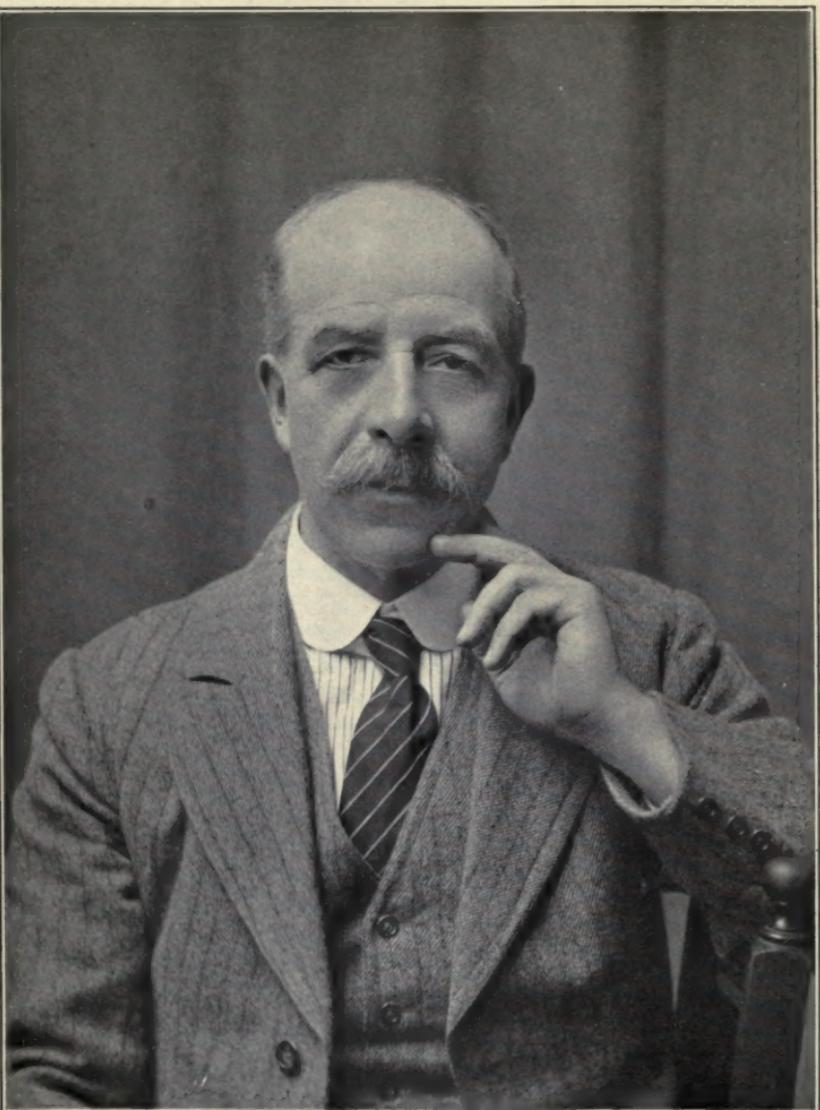
OF THE
LABORATORIES,
STAFF AND
EXPERIMENTAL
:: FIELDS ::

1872 — 1922

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By EDWIN GREY
"Field Superintendent."





Yours Truly
Edwin Grey

PREFACE.

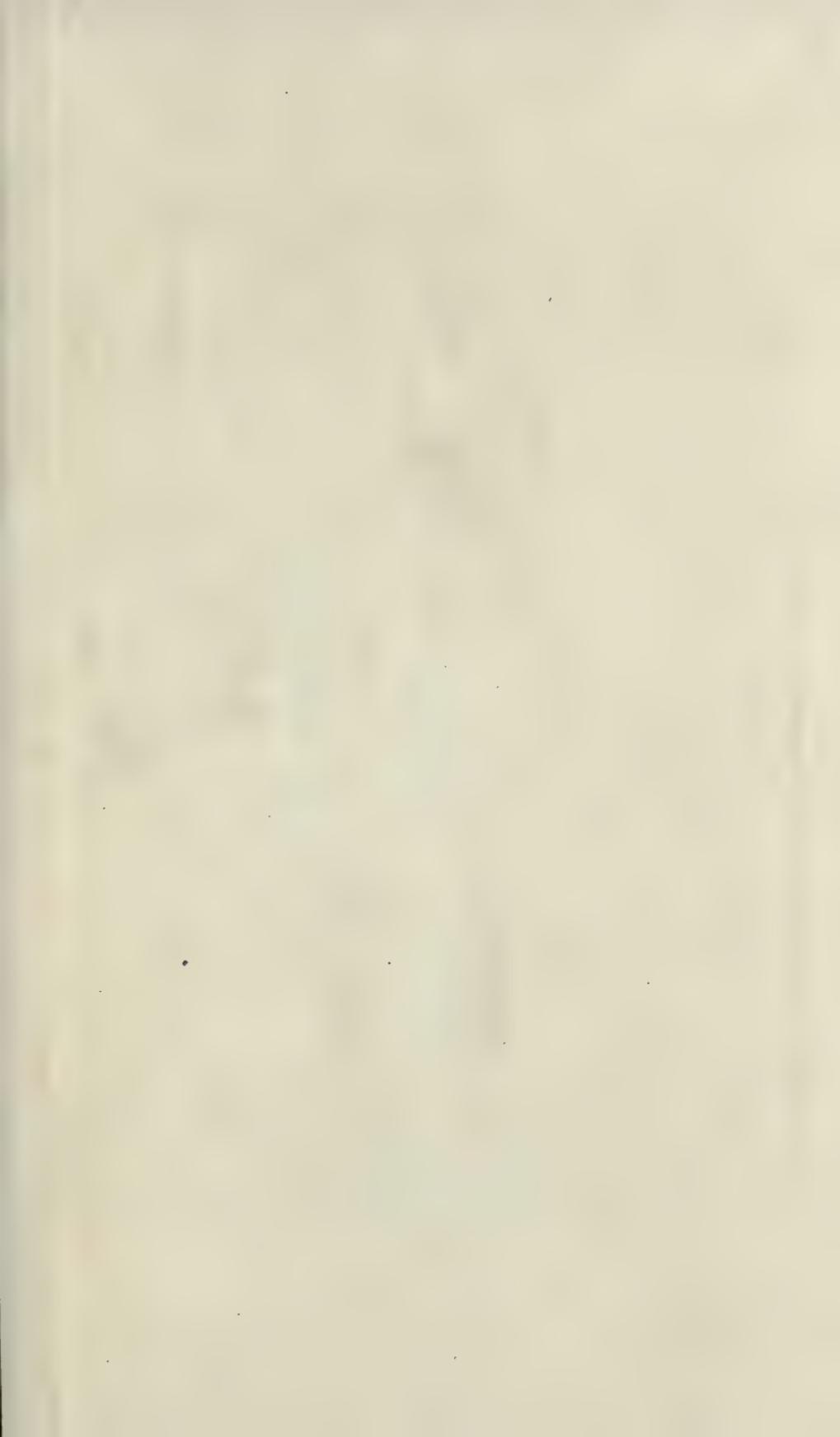
Mr. Grey's Reminiscences will appeal to all who know something of Rothamsted and of the pioneering labours of its illustrious founders, Lawes and Gilbert. Of the work they accomplished little had to be said here : this has been incorporated in the general body of agricultural science and practice, and the results, heretical and subversive as they appeared at one time, are now as firmly accepted as is anything in these days. Mr. Grey deals with the more personal side of Rothamsted, with the doings of the men themselves, not only with the great actors, but with the smaller ones also down to the humblest worker on the plots or in the laboratory. He is peculiarly well fitted for this task. Beginning as a small boy, to sort out the grasses, clovers and weeds from samples of hay, he rose through all the stages of the routine staff, finally becoming superintendent of the field plots. His genial, friendly nature has privileged him to a more intimate knowledge of his fellow workers than most people ever attain, and as a shrewd observer of men and things he has seen much more than many others could have done, even had they had the same opportunities. This he has set down in his own kindly, humorous manner, and from his record nothing has been deleted nor has there been any editorial polishing ; the record stands as he wrote it—a faithful account of the men and boys who executed the great work which Lawes and Gilbert planned.

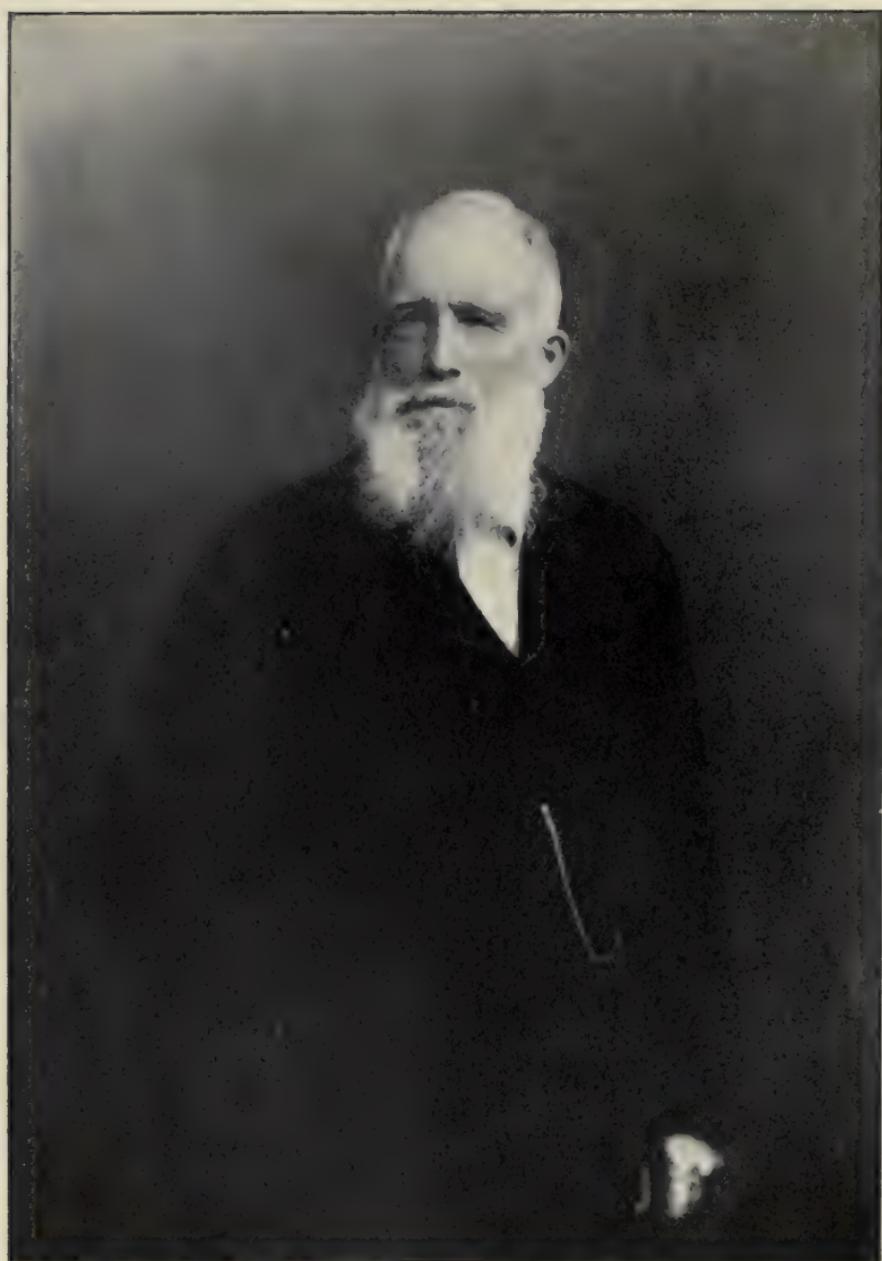
And a remarkable record it is. Lawes and Gilbert stalk through its pages, great figures : Lawes, farseeing, but with a keen sense of perspective laying down the broad outlines ; Gilbert, with meticulous care, filling in the details, giving equal attention to all of them, naturally also something of a martinet. There were no young scientific workers to help : boys from the village school were taught to do the work, and as they grew up were retained on the staff ; in turn they trained others to follow them. Great

care must have been taken in the selection, for their work has undergone the most searching tests, and it stands revealed always as a conscientious, painstaking effort with no trace of slovenliness in its execution. The method is unusual, but the results show that it answers, and Mr. Grey gives us a picture of the machine at work, with the boys gradually being licked into shape as they grew up, until they too had absorbed the high traditions and could be left in charge of the most important operations with the certainty that it would be well done. The method still remains : young men and women, including members of the second and third generation, are still following on, keeping up the old traditions, always doing their work to the best of their ability, because they know that somehow it fits into the great scheme of which they and all members of the Rothamsted staff are so proud.

Trained research workers from the Universities have now come in, and elaborate scientific investigations go on side by side with the classical field experiments. But though the plan has been so greatly widened, there has been no sacrifice in any detail of the field work, and its continuity, which is the essence of the Rothamsted experiments, is maintained as of old.

E. J. RUSSELL.





SIR JOHN BENNET LAWES, BART., D.C.L., LL.D., F.R.S.



Joseph Henry Gilbert

SIR JOSEPH HENRY GILBERT, M.A., PH.D., LL.D., F.R.S.

PART I.

EARLY YEARS: RECOLLECTIONS AS "GRASS-PICKER BOY,"
1872-3.

THE LABORATORY INTERIOR, 1874.

THE STAFF IN 1874. DESCRIPTIVE NOTES, TALES, ANECDOTES, ETC.

SIR J. B. LAWES ..	Founder and Head.
SIR J. H. GILBERT ..	Director and Ruling Spirit.
Mr. G. GIFFKINS ..	Chief Clerk.
Mr. H. O. WILLIAMS ..	Clerk.
Mr. H. ARCHER ..	Clerk.
Mr. C. B. KAYE ..	Clerk.
Mr. J. J. WILLIS ..	Botanist and Field Superintendent.
Mr. G. KNOTT ..	Chemical and General Assistant.
Mr. H. KING ..	Caretaker, etc.

Mr. R. DUDGEON ..	Ex. Steward.
Mr. F. FREEMAN ..	Expt. Farm Man.

LATER ADDITIONS TO STAFF, 1876-7-8-9:

Mr. R. WARINGTON, F.R.S.	Chemist, 1876.
Mr. W. DAVIS ..	Botanist, 1877.
Mr. J. MOULIN ..	Voluntary Worker, 1877.
Mr. W. A. PEAKE ..	Chemist, 1878.
Mr. P. CATHCART ..	Chemist's Assistant, 1887.
Mr. G. T. DUNKLEY ..	Clerk (later Secretary), 1878.
Mr. C. BIGG ..	Caretaker, 1879.

INTERIOR PHOTOGRAPH (ATTEMPTS).

GALA DAYS.



G. GIFKINS, 1852-1893.



J. J. WILLIS, 1862-1911



G. T. DUNKLEY, 1878-1917.



A. FREEMAN, 1875-1915.

PART I.

EARLY YEARS—RECOLLECTIONS AS “GRASS PICKER BOY.”

I became personally acquainted with the Rothamsted Laboratory in the summer, or early autumn, of 1872, though I had known the building from my earliest recollections, being a native of Harpenden.

I, with several other boys from the village, came to work in the Laboratory as grass pickers, under Mr. Hemsley (Botanist), in the 1872 Botanical Separation of the samples from the Experimental Grass Plots.

I was then nearing 13 years old ; in those days there was no attendance officer, we could leave school at any time.

I remember that we were about ten months at this work. I very quickly learned the peculiar characteristics of the various grasses, weeds, clovers, etc., and was soon termed the best grass picker.

Some of the boys could not learn to separate properly ; they used to put all the hairy species together in one heap, and the long-leaved grasses in another, and so on. We were not all the same boys right through the work, as one incompetent left, a fresh boy took his place.

The separation work is very tedious, and to some most monotonous, but for myself I always found interest in it.

We were given a small quantity of hay at a time, when one lot was finished we were given another small lot, until the whole sample was finished ; each boy had his own allotted space and kept his species separate.

These were carefully looked over by Mr. Hemsley, before being put away in their special receptacles, finally to be weighed up. When we came to the small broken pieces, seeds, etc., at the finish of each lot, I must confess we got very fidgetty.

Some plots were much more difficult to botanise than others. One boy named Swallow, whose place was next to me at the table, somehow whilst working at a particularly difficult plot, always managed to get his small and broken pieces finished first.

He was praised for being so quick with his work, but we other boys did not believe that he could get through so much quicker than us by fair means, so we watched, and after a time discovered

that he threw a considerable part of his small pieces into the earth closet at the back of the building.

Dr. Gilbert and Mr. Hemsley were very angry when it was found out ; Swallow had to leave at once, and it was to fill the vacancy that G. Dunkley first came to the Laboratory.

Dunkley and I became great friends at once, and we continued fast friends throughout the whole of his life.

Lady Lawes (then Mrs. Lawes) used to come to the Laboratory occasionally, and on one occasion she came to see us at the grass picking, bringing one or two lady visitors at Rothamsted with her.

Picking out a piece of grass, she asked one of the boys at the next table the name of it. "That's 'Ard-Airy,' mam," said he ; "and this ?" said Mrs. Lawes, picking up another grass, "That's 'Soft-Airy,' mam." "How do you tell the difference ?" asked Mrs. Lawes. "One's airy and 'ard, and the others 'airy and soft, and one's got a sharp point, and the other's got a round point," answered the boy. I remember Mrs. Lawes and her friends were much amused at the description. The species thus described were "Avena Pubescens" and "Holcus Lanatus." The names of "Ard-Airy" and "Soft-Airy" stuck to these two grasses throughout, we seldom spoke of them in any other way during the whole of the separations.

I cannot recollect much of the persons then working in the Laboratory. I knew their names, but I had very little intercourse with them, being entirely under Mr. Hemsley ; occasionally I was sent on a message, but very seldom.

Dr. Gilbert used to come to the Laboratory every morning. He seldom spoke to us, but conversed a great deal with Mr. Hemsley. I remember that there were in the office Mr. G. Gifkins, Chief Clerk ; Mr. H. Archer and Mr. H. O. Williams. In the main room were Mr. J. J. Willis, Mr. G. Knott, and A. Sears, the lad assistant. In the back Laboratory, King the caretaker and ashburner. I cannot remember Mr. Willis taking any part in the 1872 separation ; he may have done so, but I have no recollection of it. G. Knott did the nitrogen work. I well remember the first time I saw him washing out his flasks, tubes, etc. I thought they were very wonderful. The one character which stands out very vividly in my recollections of this early time is that of the man King, the caretaker. He went by the name of "Professor King," or the "Professor." He came from Oxford, and, I understood, used to wait upon Sir John when at Oxford University. King was a handsome man, fairly tall, slim, with curly iron-grey hair, moustache, and short curly beard. He walked rather badly, his legs having been injured when trying to put out a fire which occurred in an outbuilding attached to the old Barn Laboratory. He came to work under Sir John Lawes (then Mr. Lawes) in the Barn Laboratory in 1843.

King was passionately fond of flowers. It was he that grafted

the Red Hawthorn trees which grew in the Agdell Hedge, on the way to Rothamsted Cottage. There used to be five trees, but only one remains now.

The borders round the Laboratory were very pretty when I came in 1872. I remember there were Dahlias and Michaelmas Daisies, with background of various laurels. A clump of old-fashion roses (red, with sweet scent) grew opposite the front door, whilst in the grass round the base of the elm trees on the lawn were planted clusters of the old-fashioned double daffodil. They looked very pretty in the spring time. All that remain now of these former floral beauties are the two or three small bunches of daffodils, close up to the trunk of the trees on the south of the building, now almost smothered in the undergrowth which has sprung up round the foot of the trees.

Professor King was a terror to all children round about (none dare enter the Laboratory grounds), and we grass pickers often had the stick (a hiding, he called it). He would never allow us to enter the Laboratory by the front door, we had always to come in by the back door. He told us the front door was for Dr. Gilbert, Mr. Hemsley, and the office people, not for a lot of boys, like us. If we offended him in any way, he would stand behind the back door with his stick, and the first one of us to enter would get a sharp stroke across the back. King had a dog also, named Rough, almost as big a terror as her master. If he began to give a thrashing, she would come at us too, so we generally kept our juvenile spirits under control until we were free outside the grounds. I recollect how we tricked him beautifully once. We were almost sure of a hiding over something we had done amiss, so we persuaded a boy named "Luck" to go in first. We fitted him up with a piece of stout board up his back under the waistcoat ; he went boldly in and, of course, down came the stick on his back, but with no effect. We all rushed in, greatly delighted to think "Professor" had been taken in. When he had given us a hiding, he would say, "That's for last Monday" (or Wednesday, or whichever day it was that he supposed we had transgressed). But we soon began to get less of the stick ; instead, he would get us to pump water into the big cistern which supplied the building. He hit upon this means, thereby saving himself trouble, because it was his job to keep a good supply of water in the cistern.

Outside the Back Laboratory, in the yard near the shed, stood two articles which always excited my curiosity. One was a large chandelier about four or five feet high, with three circular tiers of candlesticks. It was tapering in shape, and always seemed to me very suggestive of merriment and festivity. The other object was a frame something like a child's cot, which stood on four legs, raising it some distance from the ground. The bottom was made of zinc, shaped like a shallow funnel.

When I knew King better or, at least, when I got more

accustomed to him, I asked him what these articles were used for. From him I learned that the chandelier was used in the early days of the Laboratory, before gas was laid on, as a central illumination, when balls, concerts, lectures, etc., were held.

An occasional ball was held here instead of at the Rothamsted House, so he told me; the dancing was in the main room, the side rooms were used for sitting-out rooms, and the Back Laboratory for the refreshment buffet. The front Laboratory, side rooms, etc., being beautifully set out with flowers, ferns, etc. Concerts and lectures, he told me, were more often held, and the Laboratory was also used for services on Sundays, whilst the present Parish Church was building.

The cot-shaped object was one of two frames used in the animal-feeding experiments in earlier days. Besides pens of pigs, there were also special pigs kept somewhat closely confined in these particular frames. I did not see the tops of the frames, but I understood that they were attached in such a manner that they could be slightly raised without becoming detached from the rest of the frame. King and another man named Tom Plummer were appointed to attend to these special pigs, one on duty at night and the other in daytime. A known quantity of food was supplied to these pigs, and for the purpose of the experiment, their voidings were carefully collected, weighed, and analysis made. When the animals had been fed and satisfied, they laid down quietly in their cots for a long time, but when hungry or wanting attention, they began to get uneasy and restless, standing up in their cots. In the attempt to stand up, the top of the cot became lifted and rang a bell which was fixed upon it. On hearing the bell, King, or whichever man was in attendance, immediately went to see what his lordship the pig required. There were also two men and three boys connected with this experiment, being endowed with sense and the gift of speech, they could do for themselves. Needless to say, they were not killed, roasted, and burned to ash, as was the ultimate fate of the pigs in the crates and pens.

There was also one other object that I wondered what it had been used for. It stood just inside the main Laboratory against the wall near the front door. This was a large and deep wooden trough, standing upon six short legs. It was like a baker's large dough trough with a cover; on it we used to throw our caps and jackets. This was called the Calomel Chest, and I learned it was used for the making of calomel in the early days. This calomel chest is still in existence, and is now used as a rough table in the sample house.

When the grass picking came to an end, we all left, and dispersed our various ways. Dr. Gilbert told me I had better go back to school for a bit, and if there should be a vacancy, he would let me know, as he would like for me to come and work at the

Laboratory. Accordingly I went back to school again, until the November of 1873. Not hearing any more from him, I left school and went to work at Field's hat factory (where Abbott's waterproof factory now stands). I stayed there until the next autumn. In September of 1874, A. Sears, the assistant under Mr. Willis, left the Laboratory, and a vacancy occurred. Dr. Gilbert sent down to the factory, asking me to come and take up the place. The factory managers were very annoyed, and would not let me leave under a month, although Mr. Willis was sent down to the factory to ask them to release me. However, in November, 1874, I came on the permanent staff, but before I actually came on to work, Dr. Gilbert asked me to send him along the last copybook I used before I finally left school. I forwarded the book, the last page in it being dated November 28th, 1873. It was the second week in November, 1874, when I started work on the permanent staff. The Laboratory was much as it was when I finished grass picking in the spring of 1873. The staff, with the exception of Mr. Hemsley and A. Sears, who had left, and Mr. C. B. Kaye, additional clerk, was the same as at that time.

I now became, as a matter of course, more intimately acquainted with every one in the Laboratory. I was placed under Mr. Willis, and had to assist him when wanted in whatever work he was engaged. For the purpose of this narrative, I think it better to describe the interior of the building as it then was. Secondly, according to my ability, the persons connected with the station at that time, and so on.

When I look at the present magnificent building, with all its most up-to-date apparatus, appliances and conveniences, I wonder how the chemists of the earlier days managed at all.

THE LABORATORY INTERIOR IN 1874.

Coming from the heat of the factory, I found the Laboratory very cold and draughty (I did not notice the cold so much in 1872). In these days there were no steam or hot water pipes to warm the rooms. One little square stove was supposed to give sufficient warmth to the main room. A brick flue under the floor carried the smoke, and also a good part of the heat to the central chimney stack in the back Laboratory.

The lighting arrangement, by gas, was then considered very good (at that time the roads and streets of the village at night were all in darkness, street lamps were non-existent in Harpenden, and not many private houses then had gas supply). I remember how brilliantly lighted the Laboratory seemed to be, when I have passed along the lower road on a dark winter's night; with the present lighting arrangements, one realises how exceedingly poor they were. Swivel brackets, with fish-tail burners, were fixed to

the east wall, one on either side of the three windows. Two similar brackets were also on the west wall. There were no central gas lights then in this room, or front laboratory, as it was always called. In the daytime, ample light was obtained from large overhead skylights in addition to that from the three windows on the east side.

A strong mahogany top bench, well supplied with cupboards and drawers, ran the full length of the room on this east side, whilst above the bench, and between the windows, were tiers of shelves containing ground samples of field crops, also bottles containing chemicals, etc. At either end of this bench was fixed a sink, gas taps for attaching Bunsen burners being placed at intervals along the whole length at the back of the bench. On this bench also was the pair of scales and the large drying boxes I had to use for drying samples of the various crops. These same scales and drying boxes are still used by Weston in the present Ash Room.

Against the west wall, central, was a large sand bath, formerly used for evaporation purposes. (At this time gas taps had been fixed in it, so that the actual sand was very seldom used.) A pipe leading into the chimneys of the back laboratory took off the fumes. On the right, between it and the door leading from the Hall, was the calomel chest mentioned in 1872; on the left, between the said sand bath and the door leading into the back laboratory, was a tall, strong wooden stand upon which were placed the carboys containing the standard acid and alkali used for titrations in the nitrogen and other work. In earlier days these were on the east side of the room, but were moved to this side for fear of the contents becoming frozen during severe frosts.

King told me that this gas lighting was a great improvement on the early days of the Laboratory. Then lamps and candles had to be used, whilst for nitrogen work, a charcoal furnace was used for combustions, and Russian lamps for drawing out the glass soda-lime tubes. I remember quite well the charcoal furnace, and the Russian lamps, brass candlesticks, etc., the lamps and candlesticks being used occasionally even at this time. One wonders more and more how those early chemists obtained results at all reliable, with only these primitive means at their disposal. Their patience must have been marvellous.

Fixed to the wall at the south end of the room was a case called the "Grass Case," illustrating and containing the botanical separations of the grass plots for 1867. At the north end was a stout wooden frame called the "Soil Case," in which a large number of samples of soils from the various experiment plots were arranged, tier upon tier; at this end of the room also were a row of iron presses. I think there were three in number; each stood upon four legs sufficiently far from the floor to allow a large basin to be placed under. They were bolted to a joist in the floor. These

presses were used to extract the juice from the pulped samples of sugar beets, mangels, or other roots.

The furniture of the front laboratory, I remember, was somewhat meagre. One fairly long mahogany table, a small square table, now in use in the sample house, one or two tressel tables and forms, the same as used in the 1872 separations. Two stools, one with leather padded top (mostly used by Mr. Willis), the other a square top wooden stool. There was one chair also. This and the square table before referred to were those used by Mr. Hemsley during the 1872 separations.

Two trap doors, or movable boards, rather, were in the floor of this room ; they were for the purpose of examining the under-floor flues in case of repairs wanted. I never saw anyone go through to do any repairs. I often saw the dust and rubbish swept down there, when cleaning up the front laboratory.

The side rooms opening out from this main room were used for various purposes. That at the south-east corner of the building was named the furnace-room. Here the nitrogen work was done, the soda-lime method being used. A gas furnace in the middle of the room, which stood on an iron slab on a brick platform, had replaced the old charcoal furnace. A bellows and gas jet, for the soda-lime tubes and other glass-blowing purposes, were now in use instead of the aforesaid Russian lamps. A small sink in the corner, and a stone bench filled up the east side, gas brackets were on either side of the window. On the west side was placed the hot-water oven used for the dry-matter samples in connection with the nitrogen determinations. This and one other tiny oven were the only hot-water ovens then in the Laboratory, with the exception of the large, bricked-in iron oven in the back laboratory. Two other rooms led off from this main room on the south side. These were called store rooms, and they contained a very large and varied assortment of samples, besides a small supply of chemicals and acids. Neither of these rooms were heated, or had gas laid on.

The room at the north-east corner was dignified by the name of the Library and Balance Room. It was lighted by two windows, north and east, gas brackets were fixed on either side of the east window. There was no stove, but there was an under-floor flue leading to the back laboratory, so that one could have been fixed up if wanted. In this small room were the volumes comprising the library of that time. They were arranged upon shelves on two sides of the room. Green curtains were supplied, which could be raised or lowered at will, covering the front of the book-cases. One or two American leather-top square tables were under the windows. On the table at the east window was the only small delicate balance then possessed by the Laboratory, with its accompanying box of weights. (Grain weights were then used.) One chair completed the furniture of this room.

All round the Front Laboratory ran a gallery with staircase leading to it from the Hall. From the floor of the gallery, almost to the roof, along the whole length of the same, were arranged tiers of shelves on which the various corns, ash, and nitrogen samples were stored. Here also were bottles containing the dried portions of the animals used for experiment purposes, together with preserved samples of the actual food supplied to them. Amongst these food samples were bottles of dried fish, sugar, etc. I know I tasted the sugar. It was of a very dark brown colour. I had to satisfy myself that it was really sugar. On other shelves were the ashes of portions of these same animals, whilst in an obscure corner were placed the dried samples of the excrements both from them and the human beings mentioned earlier in this narrative. All these various samples were labelled and stood all in their order of year, field, plot or pen. There were many thousands of them, even at this early date. On the floor, at south end of gallery, stood an exhibition case, containing beautifully made models of sugar beet roots, from selected plots of Barnfield.

A number of glass shades of various heights and sizes were placed at the top of the tiers of shelves at the north and south ends of the gallery. I understood they were used by Dr. Pugh in his experiments on plants, 1857-59. Some of these shades are still in existence ; they are now in the sample house.

The office, a small room opening from the hall and the library, was furnished with the usual shelves, cupboards, office stools, table, etc., appertaining to an office, and in addition, long narrow wooden cases which could be locked, were fixed round the room close up to the ceiling, and were used to keep the large charts, drawings, and other important papers, etc., locked away.

A small stove, with its under-floor flue, was in this room ; the room being rather small, the stove gave quite enough heat. On either side of the stove was a chair. I wondered why there should be two chairs in this small room, when the larger rooms were so sparsely supplied. (I found the reason why a little later on.) A gas-bracket, tee-shaped, with large green shades, supplied a good light for night work. Telephone, typewriter, etc., had not then reached here, all copying, etc., was done by hand.

The Private Room was on the opposite side of the Hall. It was fitted up with bench, sand-bath, gas, etc., as the main room on a small scale. The other tiny water oven, already mentioned, was in this room. A small stove with pipe carried across the room and through the wall out at the back of the Laboratory, stood in the centre of the room and gave out a good heat when the wind was the right way, and plenty of smoke blew into the room when it wasn't. In this room, I understood, most of the earlier analytical work was done.

The back laboratory had a brick floor. A square brick chamber took up a good bit of the space in this room ; opening into this

chamber were the furnaces of the sand bath, ash muffles, and the large iron drying oven, etc., the chimney stacks of the building rising from this chamber. The muffles for ash burning were a set of four, the same muffles are now placed in the present ash-burning room. The large hot-water drying oven, about 5 ft. long, was bricked in on three of its sides. The top was left free and was used for drying purposes for cloth, towels, etc. A heavy iron door opened at the north end, and a sliding shelf of sheet iron pulled out, and on it could be placed 20 or 30 large drying boxes. This same oven was in use for the extraction of fats from the carcases of animals used in the feeding experiments. Several benches, two mills for grinding purposes, and things of a very miscellaneous variety were stowed in different parts.

Near the Muffles was a long bench with a couple of drawers. On it was a very old balance used for weighing the ash; this bench was always known as King's Bench. On it later, King the caretaker, passed many of his nights, using a few dry matter parcels for his pillow. One stool and an old chair were at the ends of the bench. In the west wall were large double doors opening on to the yard at the back. At the back of King's Bench, and a little distance from it, were the cupboards containing the samples to be burned for ash. The safe containing the platinum dishes, etc., was in a lower compartment of these cupboards. The same cupboards are now in the sample house on the right-hand side, and are used for storing books, etc. Round one side of the back laboratory was a continuation of the gallery, opening on to the front gallery through doorways at north and south end. Central and immediately over the square bricked chamber below (being a continuation of the same) was the drying-room. It was fitted with upright iron standards and iron and wire shelves. A large stove stood in the centre, a thick leaden sheet covered the floor. The iron standards and shelves are the same that are now in use in the present drying-room. On either side of this drying-room, from it to the doors north and south were fitted cupboards containing the hay and straw samples corresponding to the corn samples of the various plots and fields that were on the front gallery. Suspended from an iron girder carried across the back laboratory from wall to wall, was a large swing beam scale, with strong stout square wooden pans connected with the beam by chains, hooked on to the pans at the four corners, and of sufficient height for a person to stand up to be weighed. This scale was in frequent use; it was used to weigh heavy or bulky samples, such as mangolds, soils, carboys of water, etc. They were also used to weigh the samples of hay in the grass plots and for soil samples in the fields. For this purpose a tall wooden tripod or strut was used. This strut was provided with a swivel, so that when the poles were placed in position the scales could be hooked on, and were then in the same position as when in use at the Laboratory. After

some years these scales were replaced by lighter ones for use in the fields, but they still continued to be used in the Laboratory until the present building was put up. In the early experiments these large scales were in constant use, but I never could quite find out for which experiments the figures and descriptions obtained were used, but for one of them any person could come in and be weighed on these scales, men or women. Their height and weight were recorded, also the colour of their hair and eyes were noted. They could only be weighed once ; when weighed and noted upon, each person received twopence. Tramps found out they could get a few coppers easily, so whilst the experiment lasted they had a good many of this fraternity to weigh. "Knott," the man who had to take the weights, etc., told me of some tramps who came one evening and were weighed turning up again the next morning. They had changed their hats and jackets and otherwise thought to deceive him, but he was too sharp for them and soon detected the fraud.

The back door (the same where King used to stand behind with his stick) opened into a small lobby ; from this lobby one could pass into the open, or turn into the coal shed, where was the earth closet, into which the boy Swallow deposited his small grasses.

The water supply for the whole building was obtained from the large iron cistern mentioned early in the narrative. There were two suction pipes connected with the pump, one from the well itself and the other leading from the rainwater tank close by. It was so arranged that either could be used when pumping, or only one, whichever was wanted. The water from the well was seldom used, that from the tank being quite clear and good. A service from the cistern supplied each room, wherever sinks were placed, and also the large water oven in the back laboratory.

A good supply of distilled water for general use was obtained from the large hot water oven, the steam from which passed through a tub distiller with a large worm.

For special or ammonia free water, used in nitrogen or other work, a special still was used, and either the ordinary distilled water was redistilled, or pure water from a neighbouring well was obtained for distillation, if wanting water to drink, we used distilled water.

By the side of the cistern and joining on to it at one end, was a long low shed, where the soil-breaking and various outside work was done. I might mention that the place had the reputation of being haunted. In the early days (King told me) a human skeleton, in a long wooden case, was kept in one of the store rooms, and this no doubt gave rise to the haunted rumour.

On dark winter nights the cottage women would not, if they could possibly help it, pass by at all.

The little roadway leading from the high road to the allotments

was there, but the present road past the front is of comparative recent date; only a pathway and a muddy cart track was on this side of the Common at that time. The present road was made, and the trees at the side planted, when the Common Preservation Committee came into existence.

SIR JOHN LAWES.

Of the persons connected with the Laboratory, Sir John Lawes (then Mr. Lawes) must naturally take premier place. Sir John, always spoken of among the working classes as Squire Lawes, or the Squire, seldom visited the Laboratories at this period. Occasionally he would bring friends from Rothamsted, or when any special work was being carried out he would pay a visit. Nearly every evening he could be seen, with long spud in hand, about the farm and experimental fields, keenly observant of the conditions of the land and crops.

Sir John was well known for his kindness and goodness of heart. I never heard of any one being denied who asked his aid for any deserving object. He was always ready to help in any good work, also to support any effort to benefit the agricultural labourer, both those on his own estate or of the parish generally.

The allotments, school, missions, and many other institutions of the parish were all started and generously supported by him. Many acts show his kind thoughts for his neighbours. He had circular wooden seats placed round a number of trees in his park bordering the public footpath to Redbourn, so that pedestrians from or to that village, or others taking a walk, could rest themselves. (This was before the railway connected up with Redbourn.) I well remember them, but they have all now disappeared. Other seats for the convenience of allotment holders he fixed along the Agdell hedge green, and other wooden seats with comfortable elbow and back rests were on the side of the road near the Club House. These have also long since disappeared. He it was, later on, that provided the iron seats under the trees near the village and on various parts of the Common for the use of parishioners and public generally. Many little anecdotes are told of him in which this characteristic of kindness shows out markedly. Many times I have heard the following tales repeated with pride, and I take them as true.

On one occasion, when on his way up the Station Road to go to Town, he noticed a small boy pushing a rather heavily laden barrow. On enquiring of the boy where he was going, he was told, to the station. "I expect you find that a heavy load for a small chap like you?" "It is that," said the boy. Thereupon Sir John took the barrow from the boy, and wheeled the load up to the station, to the small boy's great delight.

On another occasion, when coming from the station, he caught up with an old lady carrying a rather heavy looking parcel. He enquired how far she was going with her parcel, and learned she was walking through the Rothamsted Park to Redbourn. Sir John asked to be allowed to carry the parcel for her (as he said he was going the same way for some distance), to which she readily assented. When they reached the part where the path branched off to Rothamsted House, Sir John handed her the parcel, saying he was going to the house. She thanked him for his kindness, offering him a penny to get himself half a pint of beer.

A young ticket collector, new to Harpenden station, was taking the tickets, and as Sir John was passing out, called out, "Ticket, please." Sir John did not happen to have his "Season" upon him, but said it was all right, "the stationmaster knows me, my name is Lawes." "That may be," said the lad, "but none the more for that you'll have to come with me to the stationmaster's office." Sir John said he was quite willing. When they got there the stationmaster apologised for the inconvenience caused, saying the collector was a new lad and did not yet know all the season-ticket holders. Sir John gave the lad a half-crown for himself as a reward for his attention to duty.

One day, on looking out of one of the front windows of the Laboratory, I saw Sir John coming up the little road leading from the high-road to the allotments. Just in front of him was quite a little nurse girl, pushing a perambulator in which were seated two children. It seemed more than the girl could manage to get up the slight incline. I noticed Sir John take the pram from the girl and wheel it along until they came to the level road.

When going to London, which he often did, he seldom used his carriage to drive to the station, preferring to walk both to and from, and would sometimes chat with any cottager that he knew who happened to be going his way.

On Sundays he regularly attended service at the Parish Church, very rarely missing either morning or afternoon. He and Lady Lawes generally walked to the church, and were always there in good time.

The Baronetcy was bestowed in 1882. This and many other well-deserved honours conferred upon him are described fully in other memoirs, and need not be dwelt upon here.

Sir John died at Rothamsted, after a very short illness, on August 31st, 1900, the funeral taking place at the Parish Church on September 4th. A vast concourse of people of all classes and position attended the service, including the members of the Trust Committee, Sir Henry and Lady Gilbert, and all the members of the Laboratory staff, also representatives of all the well-known agricultural and scientific societies, and also most of the allotment holders. His remains were laid to rest among many signs of sorrow and respect.

At the very last his kindly thought for his poorer neighbours showed itself. In accordance (so I understood) with Sir John's expressed wish, it had been arranged that any allotment holder wishing to attend at his funeral was to receive each half-a-crown, to compensate for loss of work for so doing.

SIR HENRY GILBERT.

Sir Henry (then Dr. Gilbert) was the ruling spirit of the Laboratory. He was shorter and of stouter build than Sir John Lawes, whilst a gun-shot wound had caused the loss of an eye in his school days. Sir Henry would come up from his house just below the Laboratory at about 10.30 each morning, never missing when at home, staying for longer or shorter periods according to circumstances. He would see what was being done and give instructions as to any special work to be undertaken, very seldom verbally, generally by dictation. Mr. Willis, or someone in the office, would write down to his dictation. This would then be read over to him, and if satisfied, the same would be left for us to carry out. Sometimes, when anything very important was to be done, there would be what was called a regular sitting, in which every detail was discussed, and the most careful instructions for carrying out the same were given. At these sittings Mr. Gifkins and Mr. Willis generally took part.

Every day when Sir John was at home Sir Henry went to Rothamsted to consult with him, and together in the study would hold conference. The work going on was discussed, new work to be undertaken, or fresh investigations, were all planned out at these daily consultations. Sometimes these conferences extended over two hours.

In the afternoon Sir Henry always rested, working again in his own study in the evenings until late hours. Occasionally, when anything important was being carried out, Sir John would, on his return from London in the evening, call upon Sir Henry to discuss matters with him.

I have heard the farm men talk of a very amusing incident happening on one occasion. A coachman whom they called old Charlie, was ordered to take the Rothamsted carriage to meet the incoming London train. Sir John duly arrived and entered the waiting carriage. When it arrived at the Coach Lane gate (the new carriage drive to the village was not made then) he (Sir John) got out to open the gate for the coachman to drive through. Instead of re-entering the carriage, he went to call upon Sir Henry, the entrance to whose house was close to the Coach Lane gate. Charlie, thinking Sir John had re-entered, drove on to Rothamsted and up to the front door. A footman came to the door, but on going

to the carriage found it empty. "Why," said he, "there's nobody in it." "Well," said the coachman, hardly able to believe his eyes, "I'm positive I had him inside; where the blessings has he gone?" A little commotion was caused at the house, but after a time Sir John walked in. Being absorbed in his meditations, he had forgotten to say what he intended doing.

Sir Henry was exceedingly particular and careful in all matters of sampling and preparing for analysis. I became so drilled into the same careful manners, that later on, when I had to be at the Farm, superintending experimental work, the men used to say of me, "Why! you are a jolly sight more particular than the old Dr." Always, if any work was being carried on in the experimental fields, he would make it a point, after his daily visit to Sir John, to come to the fields and see how things were going along.

Sir Henry much enjoyed a good joke, and when in a chatting mood he himself would tell some laughable anecdotes. I remember how heartily he laughed over a local incident Mr. Willis told him. It was about an old lady named Betsy Peacock. She lived in the picturesque old cottage on Hatching Green, which stands alone, and somewhat back from the road, on the right, as one enters the lane leading to Redbourn, and opposite the farm. Wednesdays, being St. Albans market day, and a market the farmer of the house opposite rarely missed attending, Betsy took the opportunity on these occasions to replenish her stock of fuel by pulling his hedges round about. One Wednesday, whilst busily engaged by pulling out the wood, the farmer came up behind her, angrily asking what she was doing. Betsy, turning round, said, "Why, Mr., I thought be sure you was at St. Albans!" Sir Henry was much amused, and remarked that at least Betsy was candid.

He was extremely active throughout the many years that I knew him, but began to fail soon after Sir John's death. Though extremely weak, he would, whenever possible, walk as far as the Laboratory and discuss matters. I used to get a chair and place it by the Laboratory door whenever I knew he was coming up the path from his house, so that he could rest there a bit on entering; but he gradually became weaker and his visits less frequent. He died on December 23rd, 1901, and was buried in Harpenden Churchyard on December 27th, close to the grave of Sir John, so that as they worked together, so together they now sleep almost side by side.

Sir Henry received his knighthood in 1893. This and many other well deserved honours, like those of his companion in labour, are recorded fully elsewhere. As in the case of the funeral service at Sir John's burial, so here also, the Trust Committee, members of the staff, and many representatives of the various learned societies assembled to do honour to his memory.

MR. G. GIFKINS.

Mr. Gifkins was head of the office staff, and Sir Henry's secretary. He came in the early years—1852, I believe. When I first knew him he was well advanced in years. He was short in stature, of a cheerful and joking disposition. Mr. Gifkins was engaged in the Laboratory in the mornings and away in the, afternoons, again working with Sir Henry in his study at night sometimes until the early hours of the morning. He was a well-educated man and, in his early days, a beautiful writer, and had at one time kept a private school in a large old-fashioned house then situated in the now called Leyton Road.

Mr. Gifkins was also clerk at the Parish Church. For many years he sat "under the pulpit," as it was termed, leading the responses and alternate verses of the Psalms. I remember how very indignant he was when chanting the Psalms was first introduced at the church. In addition to these duties, Gifkins was also Registrar of Births and Deaths for Harpenden, Redbourn, Sandridge, and Wheathampsted. The people from these outlying parishes were allowed to come to the Laboratory to notify and register. It was for the accommodation of these visitors that the two chairs in the office, one on either side of the stove, were reserved. If a man came to register he would generally come alone, but a woman never, she always had another woman for company, hence the necessity of the two chairs. We in the Front Laboratory generally knew which was being registered. If very quiet, we knew it was a death; but if we heard low laughter or a joke, we said it's a birth. Mr. Gifkins kept on his work at the Laboratory for many years, until very feeble. I have known him many times, pen in hand, to fall asleep over his books, his paper often getting adorned with pot hooks, hangers, and blots of ink here and there. No one woke him, if possible, but let him sleep on; suddenly he would awake, look round, exclaiming, "The Devil! I've been to sleep again." Failing health at last compelled him to give up his work at the Laboratory (his daughter taking the post of Registrar). He died in 1893, having faithfully served in all his various duties for these many years.

Mr. H. O. Williams left the Laboratory in 1875, soon after I came on the staff.

MR. H. ARCHER.

Mr. Archer was chief clerk in the office, under Mr. Gifkins. He was a tall, slim young man, with auburn hair, moustache and short beard; he also wore gold-rimmed pince-nez.

I remember him chiefly by the tricks he played upon King,

Knott, and us boys, in fact, anyone in the Laboratory upon whom he thought he could play a trick he would do so.

On one occasion one of the staff had purchased some potatoes, a peck, I think, from King. He placed them in a bag and put them by until he went home to lunch. In the meantime, during his temporary absence, Archer removed the potatoes from the upper part of the bag, substituting carefully selected small lumps of coal. All unawares of the substitution, the bag was taken home, and not until it was opened, to take out the potatoes, was the trick discovered.

It was known that this young man would not be coming back to the Laboratory until the next morning, and so towards evening two notes (of one of which I was the bearer) were sent to his home, saying that it was rumoured he had set up in the coal trade. If so, would he send along such and such a quantity of his best.

On another occasion, when samples of mangold roots were being dried, King and another member of the staff had an argument as to which of them could stand the heat of the drying-room longest, and a bet was made.

It was agreed that both should go into the room, the door should then be shut, and the one who gave up should call out that he was beaten, so that we outside could hear.

Accordingly, at a convenient time, they entered the room and the door was closed. When once inside, Archer barricaded the door on the outside, so there was no getting out until we heard the call. There was a glass panel in the door through which we could peep and see what was going on inside. A fierce fire was burning in the stove, King stood in one corner with folded arms, smoking his pipe, occasionally coming forward to stir up the fire. The other tried to prevent him, thus making himself hotter; he also tried to open the door, without giving the agreed signal, but this being barricaded outside he could not do.

King, standing in his corner, laughed at the frantic efforts to open the door, but neither would give the call, and so the barricade remained. At length the signal was given, and Archer opened the door.

King came out smiling, but his companion, who had given the call to open, was, or pretended he was, very faint and exhausted. Archer helped him down the stairs, and he was persuaded to put his head under the water tap, whilst the water was turned on to cool his fevered brain.

Many such pranks were played by him at different times upon various members of the staff, but, notwithstanding, we all were fond of Archer; he left the Laboratory in 1883.

MR. C. B. KAYE.

Mr. Kaye was clerk in the office from 1873-78, working at the Laboratory half-days only. He was also organist at the parish church, and had been organist at Durham Cathedral. Often he would speak of this sacred edifice, and of the Venerable Bede, and other historic associations connected with it.

Mr. Kaye was an exceedingly clever organist and composer of music. Since leaving the Laboratory, several works of his composing have been issued, among them being a hymn tune named "Rothamsted," composed for the Sunday School Festival held in Rothamsted Park.

Another of his compositions was (the Rothamsted Jubilee Anthem), "All Thy works praise Thee," dedicated, by permission, to Sir John Bennet Lawes, Bart., and Sir Henry Gilbert, K.E. (the fathers of agriculture). The words of the solo, "He maketh peace in Thy borders, and filleth thee with the flour of wheat," were, I understand, chosen to suit the world-famed Broadbalk Wheat Field. This anthem has been played and sung in many places in England, and at thanksgivings at the Pro. Cathedral, Buffalo, N.Y., and at other places in U.S.A.; also in Canada at harvest festivals and thanksgivings.

Probably "Rothamsted" is the only domain in the kingdom that has an anthem and hymn tune named after its historic and world-famed name.

MR. J. J. WILLIS.

Mr. Willis was responsible for all work connected with the Experimental Plots, for the taking of, and preparation of, samples for all analytical work.

He came to the Laboratory (he told me) in 1862. He had received his education at a private school at Wheathampstead, and was good at drawing, planning out diagrams and charts. Willis was of a most amiable disposition, he was also a fluent speaker, and a capital demonstrator of the Experiment Fields, never confused or lost for a word or phrase.

At certain times of the year he was much occupied in the Experimental Fields and Plots, taking notes on the crops, etc. He made very voluminous notes; in fact, the more he made and the longer they were, the more was Sir Henry pleased. Mr. Willis was highly esteemed by Sir Henry, and was consulted by him in all things appertaining to the experiments.

I was placed under Willis, having to assist him in whatever work he was engaged at the Laboratory; I did not assist in the field work for some little time, save at the sampling of the grass plots at hay time, or at the soil samplings.

I gradually got left on my own to do the sampling, etc., at the Laboratory, and now began to have more intercourse with Sir Henry, frequently receiving my instructions from him instead of through Mr. Willis, as formerly.

Willis was also good at botany. He assisted Mr. Davies, the special botanist, in the 1877 botanical separations. The partial separations of the intermediate years up to the year 1906 were under his supervision entirely. In the year 1903 Mr. Mundy assisted him in the full botanical separation of the samples from selected plots for that season. I also had to give what assistance I could at those times. The partial separations are much easier than those of the full. At the partial, the samples were separated into three orders only, viz.: grasses, clovers, and weeds. Two, sometimes three, boys were engaged for this work for a short period each year. (Of late years girls have been employed for the botanizing work.)

Frequently Willis contributed short articles to the various agricultural and gardening papers, and occasional pamphlets on agricultural subjects were issued by him.

He was a splendid writer, bold and clear, on most of the large printed labels of the corn and soil sample bottles; the plot, year, and description were filled in by him.

Several years before his death he was afflicted with a painful disease; after operations, he would seem to recover for a time, and would try to resume his duties, often suddenly failing. He finally had to keep to his bed, where he lay for many months, always cheerful, seldom complaining, though a great sufferer. (He died in July, 1911.)

During this period of illness I often had to take over his duties in the manure shed, at the harvesting, thrashing, etc., so that at his death I was somewhat prepared to carry on his work and did to the best of my ability.

Mr. Willis was a member of and an energetic worker in many parochial societies, and at his funeral service at the Parish Church many representatives and members of these societies assembled, Dr. J. Voelcker representing the Trust Committee. Mr. A. D. Hall (then Director, now Sir Daniel Hall) and the members of the staff also attended, together with many parishioners, all gathered to show respect to his memory.

MR. G. KNOTT.

Knott came to the Laboratory in 1858. All the nitrogen determinations were being done by him when I came in 1872. There was no chemist working in the Laboratory just at that time. Knott had been trained under Dr. Pugh, who was chemist from 1857-59. At this time the nitrogen was determined every year

in samples from all the experimental plots and in occasional soil samples ; very seldom any other than the regular Rothamsted samples were done. The soda-lime method was in use at this time.

Knott used the south end of the long bench in the Front Laboratory, and so got a good light from the window at that end of the room. I remember that the Buretts and Pipetts were all marked Septims.

Needless to say that at this period the carboys of standard acid and alkali lasted a long time ; when they did come to an end and a fresh supply had to be made, I recollect a great to do was made. Knott had to be extremely careful in the making up of these standard solutions. The carboys containing the same had to be at least three days turned about, and the contents well shaken many times each day. On the third day everything had to be got ready and in order, so that Sir Henry could test the solutions. He would make several tests during the morning, the solutions being well shaken between each test ; when finally satisfied he would allow them to be used. Besides this nitrogen work, Knott had to attend to the manure sowing, seeing that each plot received its proper bags of manure as sent out from the manure shed by Mr. Willis. He also had to be in attendance at the weigh-bridge during the carrying of the hay, lifting of the roots, or during the thrashing, recording the weights of the hay, roots or straw, as the case might be, Mr. Willis being in the field or barn attending to other weighing, etc.

I was gradually brought in to learn all these various things, so that when Knott left in 1891, I was fully prepared to take on this part of his duties. Knott was also secretary for the adjoining allotments. Upon his leaving the Laboratory I was elected to take that post too. I am still secretary of the same to-day.

I remember Knott used to talk to Sir Henry quite familiarly (with proper respect, of course), and on some occasions has related some outrageous tales to him. On one occasion he told a tale of a wonderful machine invented by some crank. This machine was long, with a lot of pipes or spouts on either side. A live pig and a bag of flour were put into the machine, one turned the handle, and from the various spouts were delivered pork-pies, sausages, black-puddings, meat-faggots, tooth-brushes, combs, etc. Sir Henry gave a queer look at him when he had finished the tale, and walked away, making no comment whatever.

Once at the sowing of the manure on the potato plots in Hoosfield, I think, Sir Henry went up, as was his custom, to see how they were getting on. He called Knott to him and kept him talking for some little time. In the meantime some manure arrived from the manure shed, the man put it down on the plots he thought right, and they started sowing it. Now the man on placing the bags had turned the labels, so that 9 read as 6, and so some of the wrong manure was sown ; when Knott reached them he found

out the mistake. Sir Henry had then gone, but he heard about it the next day and spoke to Knott about it. "It's all your fault," said Knott. "You should have kept away and not come up there worrying. You called me off the plots, and you didn't want me for anything particular." Sir Henry was obliged to remain silent.

MR. H. KING.

I have dwelt on the description of King at some length in my notes of 1872. As I said there, he was caretaker and ashburner, he also, between times, did the grinding of the nitrogen samples and the preparing of the soil samples for analysis.

He lived with his family in one of the Pimlico cottages just above the Laboratory. The living room of the cottage was fairly large, and in it Mrs. King contrived to run a little general shop—thus making it a living room and shop combined. As the years went on King stayed more and more at the Laboratory, and during the last two or three years of his life seldom went home to sleep, but made a bed on his bench nearest the muffles, that end being the warmest, using a few samples for his pillow. He would go home to his dinner, etc., but would bring sufficient tea, sugar and butter from the shop to last him for some days for his teas. On one occasion he brought a fairly large lump of butter. Archer saw in which cupboard he placed it, and whilst King was away for a time, made a hole in the butter and inserted a piece of smooth brick, carefully covering it over with the butter taken out. When King at length came upon the piece of brick there was a little scene, but he never found out who played the trick.

I have known him keep a hen with her brood of chickens in the space between his bench and the sample cupboards. He kept them there for a short time during some severe weather, they being a very early brood. One day, on seeing the large drying oven door open, I looked in and found a billy-cock hat inside containing eleven eggs. I learned the hen had forsaken the nest, so King brought the eggs from home and put them there in the warmth whilst he went to try and get another hen.

He used to make laurel-berry jam, and mangel-wurzel wine, usually keeping some of each at the Laboratory. I had to taste them both—I liked neither. The jam, though of a rich colour, tasted exactly like laurel leaves, and the wine was of a very earthy flavour.

King had many curios, which he kept locked up in the safe, such as medals, bronzes, coins, etc., but the one which attracted my attention most was a red brick, of a wider pattern than an ordinary brick. It had a smooth surface and a raised rim all round. On the front of this brick were the raised figures of a man, a horse, two or three dogs, a stag, and some branches of trees,

clearly cut and beautifully finished. The man wore a Roman dress, a kind of kilt, also sandals, but no head-dress. He was represented kneeling on the ground with hands together uplifted in an act of supplication. Facing him stood the stag, as if he had turned upon his pursuer. Between the stag's antlers rose a crucifix, as if sprung from his fore-head. The horse and dogs stood at the man's side with heads bowed as if completely awed. At King's death I tried to get this brick, but Mrs. King would not part with it. I have since learned that it was a representation of the legend of St. Eustace. On a nail also hung several mummied birds. He told me he picked them out from some guano.

What puzzled me at this time was that Sir John, when he came to the Laboratory at any time, rarely, if ever, spoke to King. I thought that, having been with Sir John from the starting of his work in 1843, he would have been the first to be noticed. However, I learned the reason later. It appears that King and one or two others had plotted together to forcibly enter the cellar of the Allotment Club House and help themselves to the beer, which the brewers had sent as a gift, and which was being kept there for the New Year festive gathering. They attained their object, but quite a disturbance was caused. Sir John heard of it, and was exceedingly angry ; he never forgave King for that offence. He was sent to work in the field for a little time, but was soon re-instated at the Laboratory, but he never regained Sir John's esteem.

When an ash was finished, weighed, and ready to put into its bottle, someone would come from the office, check the weight and initial the ticket. King would give a whistle at the door, as a signal to the office people that an ash weight was ready to check. He was never allowed to enter it on the ticket without this check.

Every morning, also, he took the rainfall record. I had to go to the gauges with him (I forget who accompanied him before I went ; I think it was Sears). However, I soon had the records to take on my own, and I have continued to do so ever since King's death. He died after a short illness in 1879.

MR. R. DUDGEON.

There are two other characters which must be noticed here. They are so bound up with the work of these early years, although not actually engaged at the Laboratory.

The first of these was Mr. Robert Dudgeon, a big, strong Scotsman. He was at one time steward at Rothamsted, and had attended to the farm, and also supervised all the working of the experimental plots. The secretaryship of the Allotment Club and other offices connected with the numerous clubs Sir John started for the cottagers he also held.

Some said it was over work, others that it was because a certain lady did not return his affections that he lost his mental balance. However it was, he had to be sent away, and was away for some years. When he became better and left the institution, he came straight back to Harpenden and the scene of his former labours.

Dudgeon set up as a travelling seedsman, and with his bag of seeds tramped the country round for miles. He used to come into the Laboratory whenever he liked, no one ever ordered him out. Whenever he had a fresh supply of seeds he would come to the Laboratory and weigh out the same into one, half, and quarter ounce packets. We all bought our small seeds from him, as did also most of the allotment holders round about. We were assured they were all "very fine sarts." He went by the name of Robert or Bob, and his great delight was to forecast the yields of the different plots in Broadbalk Field. Sir Henry would say, "Well, Robert, what do you think of the dung plot, or plot 8, etc.; what will be the yield?" Robert was very cautious in his answers. He would say, "Well, I don't know, but it's my impression it will be so and so."

In stormy weather or in the winter he would often sit by the stove in the front Laboratory for hours. On these occasions he would go back in memory to his days in the institution, and would laugh with great glee over some of his episodes with the attendants. He must have been a tough customer to deal with and most obstinate. He told me how on a certain Good Friday at the asylum, an attendant was bringing into the ward a basket of buns for the tea. A large cupboard stood just inside of the room by the door. Robert noticed that the door of this cupboard was unlocked and stood just ajar; when the attendant got just into the room, Dudgeon, taking him completely by surprise, snatched away his basket, pushed him into the cupboard and locked him in. I asked Dudgeon what he did with the buns. He said he gave the other patients some of them, and with the others fed the pigeons from the window; he ate none himself, he said.

On another occasion he was ordered a bath, and he refused. It was in the evening, there was to be a dance that same night at the institution, and the attendants were wearing their white fronts and ties, etc., in readiness for it. Refusing to enter the bath, the attendants had to use force. Dudgeon noticed they were wearing this evening dress, so that when they bent forward to push him back into the bath (using his hands as a scoop) he swilled them with water, spoiling their shirt-fronts, etc., so that they were obliged to change before the dance. When relating these incidents he would laugh heartily. He never told me what punishment was meted out to him for these pranks.

He used to visit his people in Scotland occasionally, and during

one of these visits was taken ill and died among his own kith and kin. The secretaryship of the allotment club was taken over by Knott at the time of Dudgeon's mental breakdown.

MR. F. FREEMAN.

The other figure was that of Mr. Frank Freeman (father of the late Mr. Alfred Freeman).

He was always addressed as Frank, never by his surname of Freeman, and was as fine a type of the old-fashioned farm-labourer that I have ever seen. Of a kind, cheerful disposition, with a ready smile and cheerful conversation ; a rosy, weather-beaten face, thick white hair, and a soft, ancient billy-cock hat, clapped upon his head at any angle. He was what was called the "experimental farm man," and was employed mostly on the experimental work in the fields, such as marking out the plots for ploughing, sowing, path pulling, in fact, any work connected with the experiments which happened to want doing in the fields. He had help from the farm when wanted, leading the other men when engaged in experimental work.

Frank had been on this work from the commencement of the experiments in 1843, and both Sir John and Sir Henry held him in the highest esteem and respect, he being trusted by them absolutely ; his attention to the smallest details when working on the plots was remarkable.

He always did the chaffing of the hay and straw samples ; in his time this chaffing was done in the old barn at the back of Rothamsted Lodge, they were then, after being chaffed, bagged up, brought down to the Laboratory, and given into my charge.

The sampling of the Broadbalk drainage waters were in his charge also, together with many other duties.

For some years before his death he had the assistance of his son, the late Mr. Alfred Freeman. As advancing years crept on Alfred Freeman took over more and more of his father's duties, and upon his giving up on account of failing health, carried on as carefully and as conscientiously all the important duties which then devolved upon him.

The conversations between Sir John, Sir Henry, and Frank were always in quite a familiar style, Frank being always respectful and quite natural in his talks with them. One day Sir Henry was telling Frank how unwell he had been and how his throat was very troublesome. " You know," Frank, said Sir Henry, " I could not rest yesterday afternoon, or night either, I was obliged to get up frequently and gargle my throat with port wine." " I'm wery sorry for yer, Dr.," said Frank, " I should 'a' liked a chance to 'a' gargled mine with some."

On the grass plots, near the cutting time, Sir John one day was walking about them, noting the crops, etc. Frank happened to be working near, so Sir John came along to speak to him. "There are not much of crops on plots so and so," said Sir John. "No," replied Frank, "they're very poor, but yer know yer 'ant 'ort to go trompling about 'em as you're a-doing, 'cause we've got the job to cut 'em."

On Sundays, whenever possible, Frank attended the afternoon service at the parish church. Sir John and he could be seen occasionally, walking and chatting together on their way home after the service.

When obliged to give up work, he soon failed, and in the year 1900 (the same year as Sir John) he passed away.

MR. W. DAVIS.

The full grass separations came round again in 1877. The special botanist for this occasion being Mr. W. Davis. There were a different lot of boys at this grass picking, none of those of 1872 coming again.

I had a good deal to do with this separation in assisting Mr. Davis. My duties were to take the separated species from each boy, go over them roughly, then pass same on to Mr. Davis for him to give the final overhauling before putting away. Occasionally Mr. Willis assisted also.

I always remember the Christmas of this year. It was Sir Henry and Lady Gilbert's custom to give every person in the Laboratory a Christmas present. The seniors each received two bottles of port wine; each junior a piece of beef. Lady Gilbert, seeing there were so many juniors this year, thought it would be nice for them to have a beef-pie each, instead of the beef. So we brought our pie-dishes, and Lady Gilbert had the pies ready for us to take home on Christmas Eve. As far as I can remember the pies were all intact when they got to the various homes, though I heard the boys say they were greatly tempted to try them on the way thither. I fancy the cook did not approve of this pie-making, because this was the last time they were made; always afterwards the juniors had the beef.

I forgot to mention in my notes of 1872, that at Christmas that year Lady Gilbert had one huge pie made especially for us. We had a little party at the Laboratory, when we (I mean us boys) ate the said pie, the office people waited upon us, and served it. On this occasion Archer played all manner of pranks upon us.

When this 1877 separation was finished, all the boys left except H. Bracey. Mr. Davis also left. Before he actually departed he gave me his photo, which I still have.

Bracey stayed on and worked on the permanent staff for many years. He left through ill-health in 1901. He took over the grinding and preparing of the samples for nitrogen, and each year he assisted in the partial separations of the grass plots. There were many samples to be ground. Sometimes large samples of mangolds, potatoes, and grain. Bracey used to call these "Big Apoths."

I have known Sir Henry call out as soon as he entered the front door, "I can smell flour, someone's sifting without the cover on the sieve." Of course, we have told him many times the cover is obliged to be taken off to get out the remaining coarse matter for re-grinding. He was so afraid the cover was left off much too often. On one occasion, Sir Henry gave Bracey instructions about some work he wanted done. He gave these instructions verbally, a very rare thing for him to do. However, there was a misunderstanding, somehow, and Bracey didn't do the work as Sir Henry meant it to be done. "I didn't mean you to do it so," he said, "I meant it so and so." "I don't know what you meant, Sir Henry, but that's what you said," was Bracey's reply. "But I didn't mean it so," and again Bracey answered, "I don't know what you meant, Sir Henry, but that is what you said."

MR. R. WARINGTON.

In 1876 Mr. R. Warington (later on Professor Warington) came to the Laboratory. I was told that he had worked here in earlier years.

Mr. Warington was a very busy man, he did an enormous lot of work in water analysis, using what was called the "Indigo Method"; also vast and important work in connection with nitrification investigations and researches.

For his work Mr. Warington utilised the north part of the long bench in the Front Laboratory, in the dark cupboards of which he placed the bottles of solutions used in his nitrification experiments.

For the purpose of his analysis he had what was termed a Sprengle Pump. This apparatus was then thought to be very wonderful. I know it was shown to visitors with great pride. At the end of his bench, hanging from a nail in the wall, was a slate with pencil attached, with the word "wanted" written at the top of the slate. Hereon Mr. Warington would make a note of any chemicals, etc., he happened to want for his work. One day as Mr. T. Wilson, of River's Lodge, was passing through the Laboratory, I noticed him stop at this slate and write something upon it. Knowing the said slate was for Mr. Warington's sole use, I was curious to know what Mr. Wilson had written. I looked,

and under the heading "wanted" found the words, "A wife and £1,000 a year," clearly written. Mr. Warington was inclined to be angry, but soon treated it as a joke. (At that time he was a bachelor.)

Some of the Laboratory people thought Warington somewhat severe and offhanded, but to me he was very amiable; he and I worked quite well together. I was with him a good deal and assisted him in many ways in his nitrification and other work. I have known him laugh heartily at some of Knott's queer tales.

I made for him a complete set of all the plants known to be growing on the experimental grass plots, dried, mounted, and named them, botanical and common names, also later on, when professor at Oxford, I stencilled all the diagrams or tables used in his lectures. These, and the botanical set, I did on my own after laboratory hours.

When I married in 1889 he presented me with a very beautiful dinner service. Mr. Warington remained at the Laboratory until 1890.

MR. G. T. DUNKLEY.

Mr. G. T. Dunkley came on the permanent staff in the year 1878. As mentioned before, he and I were in the '72 grass work. When that was finished we both went back to school, I to the British and he to the National, I for a short time only, but Dunkley kept at school, eventually leaving the National and becoming an assistant in the British school, under the late Mr. Henshaw. There he remained until he came to the Laboratory as junior clerk, and so we two became fellow workers again. In 1883 Archer left, and Dunkley was promoted into his place, W. Wilson, of whom I shall speak later, coming in as junior. As Mr. Gifkins gradually failed, Dunkley had to take over most of the important work, and eventually, on Mr. Gifkins having to give up altogether, Dunkley passed on into his position. He now came to the Laboratory during the mornings and to Sir Henry's house in the evenings, as did Mr. Gifkins before him; eventually, after Sir Henry's death, devoting his whole time as secretary of the experimental station.

Dunkley was held in the highest esteem and was respected by everyone, rich or poor. His memory was most wonderful, he had dates, names and addresses at his finger-ends (to use a common expression). Titles, dates of publication, the writers of same, and where published, he recalled with the greatest ease, and he knew where to place his hand on the data of any work whenever wanted.

As the work of the station grew and expanded, the secretaryship became most complicated, but Dunkley managed all this difficult work with great tact and obliging courtesy, every one of the staff had become so accustomed to go to him for everything.

I had known for a long time that his health was very indifferent and, as a matter of fact, he had often confided to me that he did not believe he should be able to keep going at the pace for very long. His death occurred with almost startling suddenness. A very complicated operation was performed, and appeared completely successful, but he never regained strength to pull through. At his death the whole Laboratory staff were plunged in grief, the end was so unlooked for, one could hardly realise we should see him no more.

The whole working of the place seemed to be suddenly thrown out of gear for a time and all seemed bewildered, but, however, so it was. The Trust and the Laboratory were thus suddenly deprived, if I may say so, of one of their best workers, and I of my lifelong friend.

At his funeral practically the whole village turned out to do honour to his memory, people of all classes and social positions were gathered there. Dr. Russell (at this time Director) and all the members of the staff and other workers at the laboratory attended at the service, also Dr. J. A. Voelcker, as representing Lawes's Trust Committee; the late Lady Hall, representative of her husband, Sir Daniel Hall (the late Director), and representatives of the late Sir Henry and of Lady Gilbert were present. The service at the church was most impressive, a beautiful address was given by the Rector, the Rev. Kean M. Pitt, the concluding words of which often re-echo in my mind whenever I think of my closest friend. The words were, "He was in every sense of the word a gentleman." Dunkley passed to his rest on April 23rd, 1917.

As I have already stated, there was no chemist actually working in the Laboratory when I started in '72. I understood there had been several. A young German chemist named Richtier had been working at ash analysis, but in the Franco-German war in 1870 he had been called to Germany. Although he never returned to the Laboratory, he continued the ash analysis, the ashes being sent over to him. Of these ash samples I shall speak later.

MR. J. MOULIN.

In 1877 a young French chemist named Moulin came for a time, but I cannot recollect his particular work. Moulin had a little dog named Husyu. The dog, whenever she could slip off, would come home with me at dinner times. She looked such a poor little mite, I used to feed her, but Moulin was angry and said

he wanted to keep the dog thin. Poor little Husyu was kept tied up afterwards, but she often had a bit of food on the sly, nevertheless.

MR. P. CATHCART.

Mr. Cathcart, a young Scotsman, came in 1878 ; he did a little chemistry. I recollect he was a very pleasant young fellow ; he helped us a good bit in the hay and clover harvest. He stayed but a very short time.

MR. W. A. PEAKE.

About this time also came a young chemist named Peake. He was pale and thin, with black hair, and he was working here for three or four years. I understood Mr. Peake was a very clever chemist, but he was terribly nervous. I don't know that I ever saw such a nervous man. I well remember him giving a lecture in the National School. I forgot the subject now, but we took some apparatus from the Laboratory down to the schoolroom for his use, he was doing something with gasses, I think. There were a number of ladies in the front row of seats nearest the platform, and in explaining some process during the lecture Peake knocked over some of the glasses on his table. In trying to put these right he knocked over some others, and they in their turn upset more, until the ladies in the front jumped up in alarm and made as if to leave their seats, but were after a few minutes persuaded to resume them. Needless to say that the lecture was not a success. Mr. Peake died in the following year, after he left the Laboratory.

MR. C. BIGG.

Mr. Charles Bigg came on the staff in 1879 as caretaker, ash-burner, etc., filling the vacancy caused by the death of King, and for thirty-one years he was a faithful servant. The precaution of checking each weight of ash, entering and initialing same were, after a time, removed, Bigg being very trustworthy in all his duties. Though caretaker, his home was at some distance from the Laboratory until the present Laboratory Cottages were built. This being so, he was allowed to cook his food and have his meals in the Laboratory. He did his cooking on his ash furnaces, and sometimes, about 12 o'clock as a rule, odours appetizing or otherwise would steal into the Front Laboratory whenever the door leading into the back was opened.

Sir Henry used to sniff and, as a rule, made no comment. Occasionally he has said, "Bigg's getting his dinner ready early to-day."

I remember rather an animated discussion in the Laboratory as to whether pudding stones grew larger. Some said they did, others that they did not. However, Bigg procured some three or four of these stones, washed, dried, and carefully weighed them, he then bound them round with copper wire in such a way that he would be able to identify each one again. He then buried them, saying, if he lived, he would take them up in ten years' time and re-weigh them. I was an unbeliever in the growing theory, and as he was binding the wire round the stones I recollect chaffing him, telling him to be careful not to bind them too tight, or he might knock the sprouts off. However, Bigg never lived the ten years to be able to test his theory, his death occurring after a short illness in January, 1910. Members of the staff and of the various societies to which he belonged gathered at his funeral to show their respect to his memory, together with many of the members of the Primitive Methodist Church, of which body he was also a respected and faithful member. I tried to find the before-mentioned pudding stones after Bigg's death. I knew about the spot where they were buried, but I never succeeded in coming across them.

INTERIOR PHOTO ATTEMPTS.

Of photos illustrating this early period I think there are none. I remember two attempts being made to photograph the interior or Front Laboratory whilst the grass picking was going on. I don't know why, but, however, the exposure had to be for some length, the camera, or whatever instrument it was, stood upon the gallery at the north end, looking down on to the room, and so placed to take in a view of the grass separations then going on. I recollect the attendant did not stay by his instrument, but cleared off. I forget now how long the exposure was, but I know it was a considerable time; the boys were allowed to place their hands on the table to rest, and were then supposed to keep quite still. Now Mr. Warington was a very clever concertina player, and it was arranged that he should bring his concertina and play some selections during the exposure to while away the time. He played on an English concertina, and was the best player of that instrument I have ever heard. Most musicians keep time by tapping one foot on the floor, but Mr. Warington used to keep time by counting and by nodding his head; the effect in quick time was most comical. Mr. Warington always played from music, keeping quite correct time. It was also arranged that he should sit in the Library during his playing, leaving the door which led

from it into the front room open a bit. I had heard him play several times, but the other boys had not. When the boy at the end of the table (who could see into the Library) noticed Mr. Warington counting and nodding his time, he began to titter, but dare not move. This tittering soon spread, and in a short time everyone in the Front Laboratory became infected. Mr. Warington, all unconscious of the merriment in the next room, played on. I never saw or heard anything of this photograph.

The second attempt, some years later, also was a failure (so far as I know). Again the camera was placed in the same position as before, but this time the exposure was to be of a much shorter duration, and there was no music ; on this occasion the boys were, at a given signal, to remain exactly as they were at the moment, if they were in the act of examining a piece of grass, or placing it on the table, there the hand was to stay. Of course they got tired after a few seconds, and I remember when the photograph was developed, some boys had three hands and some were indistinct. Knott, who was also in the room at the time, ought to have stood where he was at the moment, but said he did not believe the thing was taking us, so he moved towards the door a bit, then a little further and again stopping, finally bolting through the doorway into the Back Laboratory. In the resulting photo there were two or three indistinct Knotts, and lastly a blurr, like a ghost vanishing through a doorway leaving a smoky trail.

GALA DAYS.

In addition to the regular Bank Holidays and the annual holiday, there were also two other days on which the Laboratory was closed early. These were on the occasion of the Harpenden annual races, generally the last Friday in May, and the day of the annual Allotment Club Dinner, commonly called the Club Feast, which always took place the first Saturday in June.

On the race day the Laboratory closed at noon. This event was very popular in these early days, all the county families for miles around made it a point to be at this gathering. The house party at Rothamsted always attended the meeting, very often Sir John, and sometimes Sir Henry, also attended, and always an enormous crowd of people assembled for the occasion, the event taking place on the Common. Several members of the staff held appointments there for that day. King had to assist at the starting ; the actual starter was generally some titled personage. On this day King came forth in all his glory. I never saw him what one might call fully dressed save on these occasions. His dress then consisted of a grey frock coat, grey trousers, and he also sported a grey silk hat ; in fact, as we used to say, "A regular toff." The

weakness of his legs were forgotten for a time, and he would go off quite nimbly with his red flag rolled up and tucked under his arm.

Knott weighed the jockeys, whilst Archer was in the box selling tickets for admission to the grand stand. Knott and Archer went off with less flourish than did King, no doubt King felt his superiority, having to be amongst high society for a few hours. However, this day was generally one of great excitement.

The other, the Allotment Feast day, was not so intensely exciting ; several of the staff went to the dinner, being members of the club. The Back Laboratory was for the time being turned into a kind of kitchen, with such an array of baking tins, dishes, pots, pans, etc., only seen on that day ; but of this Allotment Club I must speak later on.

PART II.

INTERIOR IMPROVEMENTS.

THE CONGESTED BUILDING.

OTHER ADDITIONS TO STAFF, 1882-1891. DESCRIPTIVE NOTES,
TALES, ETC.

Mr. T. WILSON	1882,	Translator.
Mr. W. WILSON	1883,	Clerk.
Mr. D. A. LOUIS	1882,	Chemist.
Dr. N. H. J. MILLER	1887,	Chemist.
Mr. H. LAWRENCE	1891,	Assistant Chemist.

ANNUAL WHEAT CROP LETTER.

THE LAWES AGRICULTURAL TRUST, 1889.

GRASS SEPARATIONS ('MARKET HARBOROUGH'), 1879, 1880, 1882, 1888.

DR. GILBERT'S MEADOW EXPERIMENTS.

ENSILAGE MAKING, DAIRY AND FEEDING EXPERIMENTS
(METHODS, ETC.), 1884-1889.SOIL SAMPLING AND PREPARING. QUAINTE METHODS, TALES,
ANECDOTES, ETC.SAMPLING :—RAIN AND DRAINAGE WATERS ; MANGOLD ROOTS,
LEAVES, ETC. METHODS, TALES AND ANECDOTES.

SUPERPHOSPHATE MAKING, ETC.

MANURE SOWING : METHODS IN EARLY AND IN LATER YEARS,
TALES, ETC.

NITROGEN FIXATION EXPERIMENTS, 1888-1894.

ASH MIXTURES (FOR ANALYSIS) ; METHOD.

DIAGRAM AND TABLE MAKING (FOR LECTURES, ETC.)

CORN VALUATIONS (SAMPLES FROM EXPERIMENTAL PLOTS),
1899-1902.

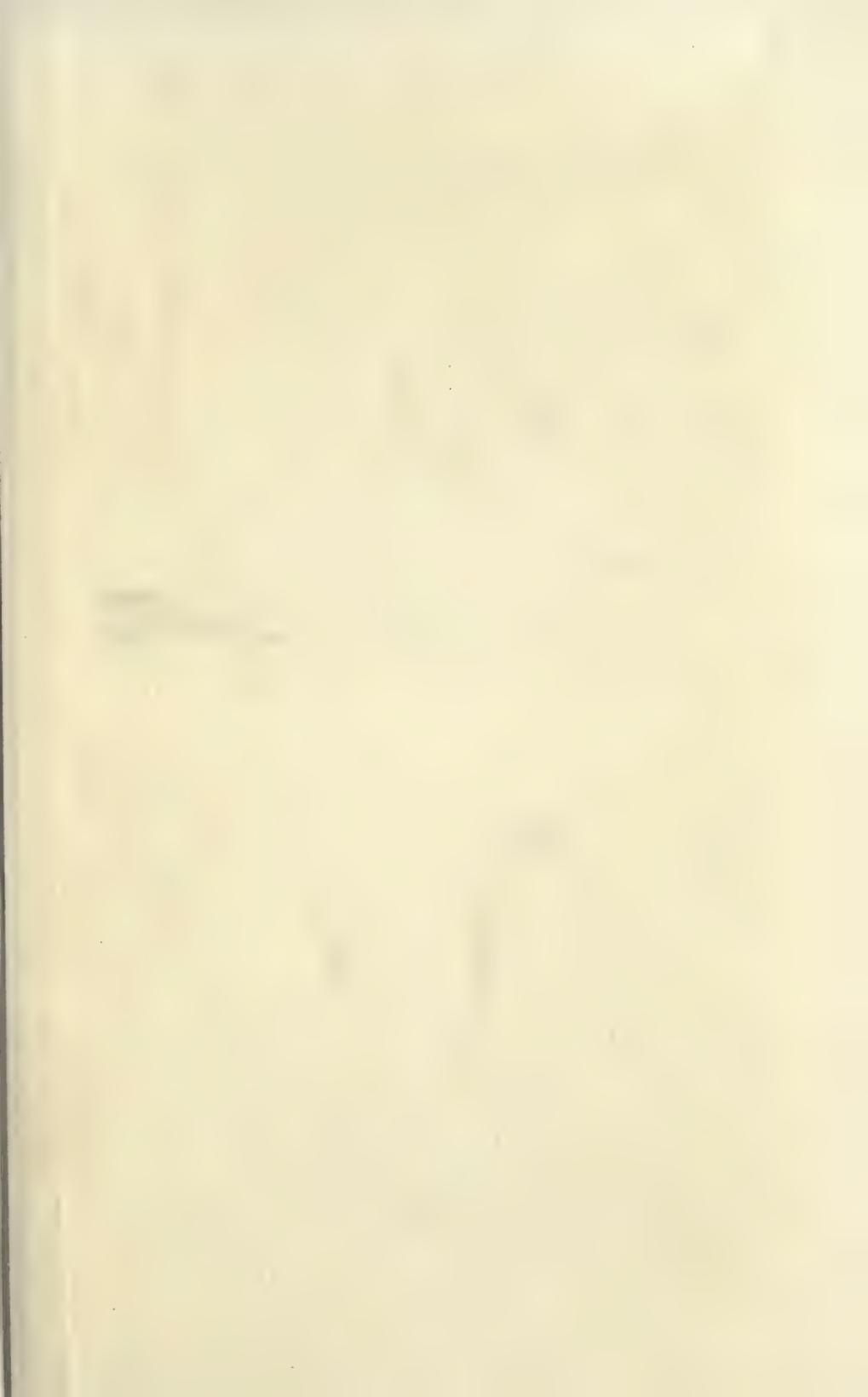
NITROGEN WORK.

THE JUBILEE, 1893.

A. OGGELSBY, 1901.

VISITORS (HUMOROUS TALES).

Dr. J. A. VOELCKER, Director *pro tem.*





LAWES' TESTIMONIAL LABORATORY, 1855. DEMOLISHED 1914.



JAMES MASON LABORATORY, ADDED 1906, NOW INCORPORATED
IN THE PRESENT BUILDING.

PART II.

INTERIOR IMPROVEMENTS.

In the late '70's or early '80's considerable improvements were made in the Front Laboratory. A new mahogany top bench was placed at the south end of the room, leaving a gangway about eight feet wide between it and the grass case. This bench was fitted on one side with various sized drawers, and on the other side with cupboards, and cupboards also at either end. A tee gas standard was provided for this bench with swivel brackets, these were the first lights provided for the middle of the room. The scales and drying boxes were removed from the long side bench and placed here. The bench was made by a man named Abrams, his son assisting him; they had their work benches in the back laboratory; I remember the father did most of the work, and the son most of the swearing. I often think of young Abrams coming up to me in the Laboratory one day, saying, "I say, old 'un, I can't make out how they make this bloomin' place pay."

The little square stove had already been removed and a larger and much more suitable one put in its place. This stove was brought down from the billiard room at Rothamsted. The under-floor flue was used no more, a large pipe from the stove was carried upwards and across the room into the drying-room chimney. The temperature of the room was now much improved and altogether more comfortable. The special scales for weighing pots and growing plants, in the early experiments, were altered and adapted for present use. Abrams made a mahogany case for this scale, and they were placed on a strong table between the sand bath and the stand for the standard solutions. These scales came in most useful during the big soil samplings later on, and have been in constant use ever since. They are now used in the sample house. New shelves were also added in the Library, so that all the wall space was utilised.

Somewhat later on, a second and similar bench to the one at the south end was made for the north end of the room by a cabinet-maker named Jenner, and the row of presses before spoken of were removed to make room for it.

THE CONGESTED BUILDING.

During the years 1881–5 many soil samples were taken from various experimental plots and fields, and was what we called deep depth sampling, sometimes going down to the twelfth 9 inches. When the enormous number of samples so obtained were broken up, prepared, and the requisite samples for analysis and stock weighed out, they had to be stored somewhere in the Laboratory. The shelves were already filled up, so room had to be found upon the floor of the gallery, wherever we could find a space, also some on the floor of the front laboratory. The place gradually became so congested, there was hardly room to move about, save in the gangways reserved for the purpose.

The laboratory itself began to show serious signs of giving way. Buttresses were built outside against the east wall, and strong iron rods were passed through the building, so bracing the walls and making them more safe.

This state of things continued for some few years until 1889, when the present sample house was built. This building is fitted up with iron supports and shelves. All the soil samples from the floors and gallery were removed there, also all the corn samples from the gallery shelves. The samples from the soil case at the north end of the front laboratory being also deposited there and the case itself removed.

Some time before this some of the stock samples of grain were found to be attacked by weevils. The beetles had bored their way through the corks and so obtained access to the corn. When this was found out, all the samples thus attacked were emptied out of their bottles and re-dried in the water oven, to kill off the weevils. The whole of the bottles containing the corn samples were then taken from their shelves, the corks dipped in paraffin wax and finally fitted over with capsules. Since then the corks of corn samples have been waxed over as soon as bottled.

Most of the cupboards from the back gallery with their contents were also moved across to the new Sample House, and for a time all the drying of the mangold roots, leaves, etc., was done in the new Drying Room built there; but the drying operations were soon transferred back again to the old Drying Room, Bigg being unable to get up and keep a proper temperature as in the case of the old room. This new room is now used for storing the stocks of pamphlets and books, and is called the Store Room.

MR. T. WILSON.

About the year 1882 Mr. T. Wilson, of River's Lodge, came to the Laboratory as Translator. He was, I think, a cousin of Sir Henry's. Mr. Wilson came in at no stated times, but whenever he felt disposed, not being of very robust health.

He was a very clever linguist and an enthusiastic meteorologist, and, I remember, a great advocate of what was called "Rational Spelling," or spelling words as they are spoken, also of the decimal system he was an advocate. He introduced Fuller's spiral slide rule into the office for checking purposes. Mr. Wilson was at translation work for a number of years, leaving about 1893.

MR. W. WILSON.

When Mr. Dunkley was promoted to fill the vacancy caused by Archer leaving in 1883, W. Wilson came in as clerk. Wilson and I were not strangers, he being employed as clerk at the factory the same time that I was there in 1873.

He was slim, pale complexion, black hair, very quiet in manners, a very quick and neat writer, also exceedingly quick in calculations. W. Wilson proved of great assistance to Dunkley in his complicated work. On Mr. Dunkley going up into Mr. Gifkin's place Wilson passed into the vacancy thus caused and a lad came into the office as junior clerk. I remember three lads, Hall, Abbott, and Barnett, neither of whom stayed but a few years. Wilson married a few years after he came to the Laboratory, and a sketch was drawn by Mr. Louis, soon after the event, entitled, "Wilson, before and after Marriage." Before marriage he was depicted as a slim figure, wearing a bowler hat which seemed much too large for him. After marriage he was shown as having filled out in the face and considerably stouter in figure. The bowler, before so large, is now shown perched on his head like a little pudding basin. Wilson certainly did get somewhat stouter after his marriage, but the drawing was so comical that we laughed heartily over it, Wilson himself being as much amused as we were. In fact, he kept the sketch in his drawer for a long time.

A very laughable occurrence happened one day in which Wilson was the prominent figure. Bigg, the caretaker, always kept a heap of coal by the side of his ash muffles. This heap of coal was directly under the floor of the back gallery. Bigg having finished tea, had emptied the leaves on to the coal, leaving the teapot standing on the coal whilst he went to attend to the drying-room fire. Wilson had a message for Bigg, and was walking along the gallery to the drying-room, when suddenly the floor gave way and Wilson was shot through the opening, landing on the teapot and coal. He stared about in astonishment, hardly knowing where he was. However, he was not hurt, and only the teapot broken.

For some years before his death he suffered from a very distressing illness. For a time he seemed to recover, and came back to his work, but the complaint soon returned, and after a very long illness, most patiently borne, he passed away on December 28th, 1916. The funeral service took place in the Congregational

Church, of which place of worship he had been an active member for many years. His remains were buried in the Parish Churchyard. Many of the Laboratory staff attended, and a large number of people assembled to show their last respects.

MR. D. A. LOUIS.

Mr. Louis came as a chemist in 1882. He was short in stature, with jet black hair ; very lively and full of pranks. He did a deal of work in nitrates in soils, nitrifications, etc., also an enormous number of analyses of the Broadbalk Drainage Waters. For his use in the soil work he had a large array of soup dishes ; each dish was numbered by file marks.

In these dishes were placed samples of sifted soil from various plots. They were damped from time to time, stirred about with glass rods and returned to their dark cupboards until they were wanted for their particular purpose. There were no filter funnels or Buchnar funnels, nor suction pumps in those days, but to answer the purpose of such, a small tank was placed upon brackets fixed in the wall over the calomel chest ; above the cistern a water tap was fixed, so that it could always be kept nearly full of water. A pipe from this cistern connected with a mercury arrangement fixed to the wall, boxed in with detachable front. To this apparatus a leaden tube was attached which passed through the wall, under the floor of the back laboratory, underground across the back yard, and finally 60 feet down the well. When the apparatus was to be used, the taps were turned on, allowing the water to pass down the pipe into the well, thus creating a suction sufficiently powerful for the purposes required. In the place of Buchnar funnels, etc., when extracting, inverted bottles cut off to about a third, with necks attached, were used, fitted with wire gauze, and the wire covered with filter papers. Four of these inverted neck parts were generally used at the same time, being fitted into a frame for the purpose.

Louis was very fond of teasing the grass-pickers. One boy in particular he used to tease continually. His name was Harris. He was quite a little chap ; the other boys used to call him " Little Winkie." Louis, whenever he passed by " Little Winkie," could never resist the temptation to pinch his ear, or pull his hair, or in some way tease him, but notwithstanding all his teasing, the boys were wonderfully fond of him ; sometimes he would bring them a bundle of neck-ties from his home, or some other thing.

He resided for a good time in the village, lodging at the Brewery House. The rest of the time he went to and fro, night and morning, to his home in London. Being about the same age, Louis and I became great friends, both in the Laboratory and outside, notwith-

standing the difference in our social positions. The boys and I, in fact, all in the Laboratory were very sorry when he left in 1887.

DR. N. H. J. MILLER.

In 1887, soon after Mr. Louis left the Laboratory, Dr. Miller came as a chemist. He was altogether a contrast to Mr. Louis, very quiet and reserved, hardly ever conversing voluntarily with anyone save Sir Henry and myself. I understood that he was an exceedingly clever chemist, and wonderfully well-read. Dr. Miller continued the analysis of the Barnfield rain and drainage waters and also the drainage samples from Broadbalk Field. A deal of important work was done by him in the deep depth samples of soils from Broadbalk in 1893, in analysis for nitrates, etc., carbons in soils, changes in the composition of mangolds during storing, and much other analytical work.

Of photographic work Dr. Miller did a great deal. An enormous number of photos of mangold samples ; of plants, with their roots and nodules, grown during the experiments on the fixation of free nitrogen, and many other subjects were products of his camera.

By this time a water service from the water-works had been installed, one of the store-rooms, the inner one, on the south front of the Laboratory, had been cleared out, dark blinds fitted to the windows, and converted into a developing room. A good deal of more up-to-date apparatus was purchased, but when doing soil extractions for nitrates, Dr. Miller generally preferred the before-mentioned apparatus on the wall, and its accompanying water-cistern. The private room was also cleaned, repainted, water laid on, and fitted up for his particular use. This room became very private indeed, hardly anyone but he and I used to go in it. Dr. Miller and I were very friendly. In fact, I seemed to get on well with everyone. It seems strange, but so it was ; perhaps it was because I took no notice of their moods. If not amiable, then that was their look-out—I appeared to take no notice. I helped Dr. Miller a great deal in his various works. Sometimes I hardly knew how to get through my own and help him with his. I have known him, when I have been away in the fields or otherwise, to put things off for a week or even a fortnight, until I returned—he would ask no one else to help him. I recollect when Sir Henry received his knighthood we were all invited to dinner by Sir Henry and Lady Gilbert, the dinner being at Sir Henry's house. We wanted to make a suitable present, so we started a subscription list among the staff, and with the money so obtained bought a silver card case and, I think, had Sir Henry's initials engraved upon it. Dr. Miller, being the highest in social position among us, was asked if he would make the presentation. He consented,

and after dinner the card case was presented by him, accompanied by the shortest presentation speech I have ever heard. This reserve gradually passed off during the latter part of Mr. Hall's directorship, probably because there was more activity and fresh people. He could now often be seen in animated conversation with the research workers and others on the various subjects under investigation, his advice being often sought and most readily given. Always at Christmas time he would place cigarettes in the drawer of the bench where I was working. He said nothing about them to me, nor did I ever actually see him put them there, but so sure as Christmas Eve came round, so sure were there tins of cigarettes in my drawer.

His death occurred with tragic suddenness in the night of January 13th, 1917. At this time he was busily engaged in arranging and tabulating the volumes for the new library, a work in which he took the keenest interest.

The funeral service was held in the Catholic Church, of which he was a member, his remains being interred in the Parish Churchyard. Dr. Russell (then Director), the members of the laboratory staff, also many well-known people and prominent parishioners attended the service to show their respect to his memory.

MR. H. LAWRENCE.

In 1891 Mr. H. Lawrence came to do the nitrogen determinations, etc. When Knott left the Laboratory I took over the field part of his work, and Lawrence the chemical part. He came from the Laboratory of the R.A.S., Hanover Square, and had been used to the Kjeldahl method. The old soda-lime method was very soon abandoned and the Kjeldahl method used, but for a short time both methods were in use, nitrogen determinations being made by both in the same samples. The new apparatus was obtained by Dr. Miller, and was a very neat affair. The combustion part of it was very small. It consisted of a circular set of six mushroom burners, a circular sheet iron plate above, with six holes over the burners on which were placed the combustion flasks, all pointed inwards, resting on a circular rest provided at the top of the apparatus. This part was soon discarded, being much too small for our purpose, but the distilling part is still in use in the distilling room. A larger combustion set was fitted up in the furnace room, and the room altered and adapted for the new Kjeldahl method. The old brick platform, etc., was cleared from the middle of the room, being replaced by a lead-covered table on which was placed the distilling apparatus. The stone bench on the east side was also covered with sheet lead, upon which were kept the bottles of sulphuric acid, soda, etc., whilst

on the opposite side was fitted a fume cupboard, in which was placed the larger combustion set just mentioned. A pipe passing through the wall carried the fumes into the open air. This answered very well at times with the wind in certain directions, but at other times the fumes were blown back into the room, and the atmosphere then was very bad.

During the time that Lawrence was at the Laboratory he was very seldom allowed to do any other than the nitrogen work, nearly all of which were the determinations of nitrogen in the yearly samples from the Experimental Plots, or soils from the said plots. On one occasion he did a lengthy series of determinations in a set of deep-seated clay from the Geological Survey Office, London. I think that was in 1900. He also in 1895 and for several seasons onwards did determinations of sugar in water extractions of the pulped mangolds from Barnfield. Now Lawrence was very energetic, and consequently could have worked through the samples much quicker, but Bracey could not get them ground up any faster, and although Lawrence was good in other branches of chemistry, such as ash analysis, water analysis, etc., Sir Henry declined to let him do any other, scarcely, than nitrogen work. After a time Lawrence came to the Laboratory mornings only. He set up in business in the village and devoted the remainder of his time to it.

I recollect that owing to so many glass flasks getting broken during the distillation of the soil residues, Lawrence had a set of copper vessels made for use during these distillations; but they did not answer for long, being unable to see the contents inside, the vessels were sometimes left too long on the flames and the bottoms got burned out, so the glass flasks were soon taken over again. In 1901 Lawrence left. He and his family shortly after went over to New Zealand, where he has now become the, or one of the, leading private analytical chemists in those islands.

ANNUAL WHEAT CROP LETTER.

Sir John's annual letter to the *Times* on the wheat crop, in which he forecasted the yield of wheat in the United Kingdom, and the imports required, etc., was always looked forward to with great interest. Immediately after the thrashing of the Broadbalk crop the figures were taken into the office and the clerks set to work tabulating the results and collecting data for Sir John's use. When the thrashing has been late in the season I have known Sir Henry send to the barn for the figures, and we have sent the results down to the Laboratory every few plots as we finished them. This annual letter was, I believe, begun in 1862, and was issued every year until Sir John's death.

Dudgeon was always very anxious to see how the plots turned out, to know how far his forecast of the yields compared with the actual.

THE LAWES AGRICULTURAL TRUST.

In 1889 the Lawes Trust Committee was formed. The object for which this committee was formed, and the endowment of £100,000 by Sir John, are dealt with fully in most of the Rothamsted memoirs.

Of the gentlemen composing the committee I knew but little. Sir John Evans, Professor Armstrong, Dr. J. A. Voelcker, and Dr. H. Brown I knew best through their more frequent visits to the Laboratory, and of these Professor Armstrong and Dr. Voelcker are best known to me, and later Mr. Spencer Pickering. The committee's annual visit was always looked forward to with interest, and preparations made for it accordingly.

OTHER GRASS SEPARATIONS.

During the years 1879, 1880, 1882 and 1888 many samples of grass from the fattening meadows of Mr. E. M. Fisher, Market Harboro', were botanized fully. At certain times of the year Mr. Willis went down to the meadows and sampled the grass. He, I, and any of the boys that happened to be working here, did the botanizing work.

DR. GILBERT'S MEADOW.

The little meadow adjoining Sir Henry's house (always called Dr. Gilbert's meadow) also came under experiment, and for a number of years received a certain manurial dressing. Botanical notes were taken fairly frequently by Mr. Willis, who used to go to the meadow and botanize the crop as growing. At haytime the produce was weighed and the weight recorded. I recollect one year there were four weighings. They were all odd weights, but the total happened to work out just even tons. Now Sir Henry would not believe that the four loads weighed just that even weight, and said I must have made a mistake in my weighings. However, I assured him they were right, but it was a long time before he reluctantly consented to take them as correct.

ENSILAGE MAKING.

Two silos were made about 1884. They were what we call below-ground silos, and were like huge cemented tanks, capable of holding about 100 tons each. They had brick walls built above

ground, and were roofed in, doorways being left in one side of each wall for filling purposes. (These silos are still standing, the below-ground tanks being filled in with earth. They are now used as wood-sheds.)

In one silo was placed green clover, and in the other grass. The grass and clover were chaffed and weighed as put into the silos, and samples were taken, whilst the chaffing and filling proceeded; as many men as could be spared were engaged in treading and consolidating as much as possible. The filling proceeded until the bulk was some distance up the walls above, then planks were laid, upon which layers of heavy black bricks were piled; in various places holes were bored in the planks and perforated iron tubes inserted, being pushed into the ensilage to different depths. Thermometers were suspended in the tubes, and it was my duty to record the temperatures each morning. The contents soon began to settle down, and when this settling was completed the bulk was about the ground level, the below-ground tanks thus being completely full. It was left thus until the winter, and then used for the purpose of feeding experiments (oxen) and for dairy experiments.

The contents were taken out in layers and weighed, and as each layer was being used samples from the same were taken. I had to do all the sampling, bringing the same down to the Laboratory for analytical purposes.

Now of all odours I think that of ensilage is the most penetrating. It is neither sweet nor sour, a faint, sickly sort of smell. I thoroughly detested it. Gloves on the hands did not stop it penetrating the skin of the hands.

One evening I was invited to a party. It so happened that on that same day the detested sampling had to be done. I tried to get out of it, or find some substitute, but could not, and sampling I had to go. However, before I went to the party, I bathed and used soda instead of soap when washing my hands, also some scent (not ensilage). I thought I had now surely got rid of the objectionable smell, and I went gaily off to the party. As the people assembled, and the evening wore on, the atmosphere began to get rather heated. Whilst at supper I noticed a faint smell of ensilage wafted about. The young lady sitting next to me began to sniff. Turning to me she said, "What a disagreeable odour there is about; can you smell it?" I hardly knew what answer I made, but I think it was "Yes, someone is using some uncommon scent." I know I hastily turned the subject. I was very glad when the meal was over.

DAIRY EXPERIMENTS.

Lengthy experiments extending from 1884 to 1889 were made. A herd of cows about forty in number were kept for the purpose.

They each had a name, either the name of a lady or a flower. The yield and weight of milk from each cow was recorded, and according to the yield so the amount of cake supplied was graduated. In the summer, when there was plenty of grass, only cake was given in addition, but in the winter chaff and roots were also supplied.

My share in these experiments were to take samples of the milk and determine the butter fat. The apparatus I used was a very neat and compact set, and was called a lactobutyrometre. There was another set of experiments to test the feeding value of ensilage. In this experiment both cows and oxen were used. In the case of the cows the same process was gone through as in the other experiment, about half the number being kept.

Two lads who had been grass pickers took on as record keepers, one named Luck, 1884-87, and the other, Newson, from 1887 to 1890. When they were unable to go through illness or some unforeseen circumstance, I have taken the records for a time, and the lad Harris has also taken them. There is a note in one of the Record Books by Harris, recording the remarkable fact that "Through there being no cake, the cows got only half a lot."

The ensilage often gave a faint, almost imperceptible, odour and taste to the milk, and sometimes a very, very faint tinge of brownish colour. Now Sir Henry prided himself on his keen sense of smell, and told Willis and Louis that he could detect the ensilage fed milk from the other by smell alone without either seeing or tasting. So to test his sense of smell two glasses of milk were procured, one of each sort. Sir Henry having shut his eyes, these were placed before him, and the serious process of smelling them began. Sir Henry hit upon the right one, but, however, he said he would smell again, and shut his eyes for the purpose, but before he could pick them up to smell, and whilst his eyes were shut, Mr. Louis, by a quick movement, transposed the glasses. When Sir Henry smelt again, he hesitated, seemed puzzled, and setting them down he said, "Well, it appears to be the other one now." Not being satisfied, he again shut his eyes, and was about to pick up the glasses when again Mr. Louis did the rapid transposition, so this time it was as the first. There the matter rested. We all were convinced that Sir Henry had cause to be proud of his smelling powers.

FEEDING EXPERIMENTS, ENSILAGE.

Ten oxen were also used for the ensilage feeding experiments. Five were fed with cake, barley-meal and clover ensilage, and the other five had the cake and barley-meal, with clover hay and swedes instead of ensilage. These oxen were weighed at regular intervals, and I remember what exciting times we had getting them on to the weighbridge. As soon as they got outside the stall and

found they were in the open, they threw up their heels and darted off anywhere except to the place we wanted them to go.

I forget whether it was in connection with this experiment with oxen, but at the finish of one of them I had to be at the slaughtering, to weigh all the parts of the animals as they were being dressed ; carcase, hide and hoof, in fact, all and every part distinct, including the stomach, intestines, etc. This was a job I did not relish. I was always glad when it was over. I am certain I could never have followed the trade of a butcher.

SOIL SAMPLING AND PREPARING, ETC.

As before stated, soil samples were taken from the various experimental fields, called long-period samples ; deep samplings being then taken. The frame being driven down twelve times. Four holes were generally made upon each plot, so that an enormous number of samples were obtained at the final weighing up. Mixed samples of the four holes for each depth were taken, also single samples of each hole and depth, both for stock and for analytical purposes.

In the earlier years the top depths were always taken by a 12"×12"×9" frame, and the lower depth by a 6"×6"×9". Of later years all depths have been taken by the smaller frame. These frames, or sampling irons, were made of stout sheet iron with stouter bands of iron riveted round the top. This sort of frame was used for many years, but was constantly having to be renewed. Sometimes, when coming across a large flint, they would be buckled up, and often had to be sent to the blacksmith to be straightened out. During the more recent years a steel frame has been used, the bottom of which for about four inches has been hardened by a special process. Wooden rammers are used to drive down the frame, and when driven down to the level surface the soil is taken from the inside of the frame, weighed, bagged up, and labelled. This would be the first depth ; to ensure that the proper depth of soil is taken out, a small wooden 9-in. gauge is used for the purpose. A cover is then placed on the frame to prevent any outside soil falling into the now empty box, the surrounding soil being then removed until again level with the bottom of the frame. The cover is removed, the sampler driven down until again level with the soil, and the contents of the frame again taken out and weighed. This would be the second depth, and so the process continued until the whole of the twelve depths were obtained.

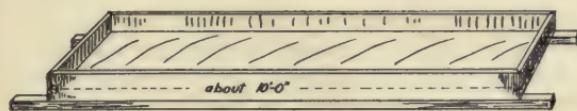
When taking these deep samples it was necessary to have large holes in order that the men could have room for working. As the earth was removed from round the sampling iron, each depth so moved was placed in order, and at the filling in of the holes

the soil was replaced in its proper depths. A man named Burgess, who was a good worker at this soil job, used to get very excited whenever the sampling iron came to grief (he always called the sampler a pot). Sometimes when I have been at the scales weighing, he would come hurrying up and shouting out as he came, "That there bloomin' pot's gorn ag'in." He would laugh out loudly, and suddenly turning serious, would say, "What shall we do now, we shall have to bamacks (straighten) it out."

When I came in November, 1874, the soil samples taken from Agdell in the previous month were being prepared or broken up. At this period the samples were not dried off at once as they were taken, nor were they spread out to air-dry, but lay a time in their bags until they could be chopped up fairly easily and passed through a quarter-inch sieve. The final samples were then taken, those for stock being bottled up at once, although still damp, those for analytical purposes being properly dried and pounded up to pass a very fine sieve. When Mr. Warington's nitrification results were obtained, these old stock samples were taken from their bottles, dried, and rebottled. Since then the samples as they come from the field have been at once broken up and dried at a gentle heat in the Drying Room, or, as lately, broken up and spread out to air-dry. It was in one of these 1874 stock samples that a fern started to grow, and has been growing there ever since, although the bottle has been always corked up. This sample was not re-dried, so that apparently the soil was sufficiently damp for the plant to thrive, and it must have used moisture and air over and over again. It was quite a vigorous plant in 1915 when, unfortunately, the original bottle got broken. The fern roots were disturbed when being put into another bottle, so that now it looks very poorly, though still living.

Frank and another man named Saunders were engaged in chopping up these aforesaid soils, which were being prepared in the long shed at the back of the Laboratory; on the floor of the shed was a very strong wooden board about twelve feet long and four or five feet wide. It was called the Chopping Board, and was lined with very hard wood, called teak, having a raised edging all round of about 6 inches. They were using a kind of four-bladed suet choppers made of stout sheet iron, with long central wooden handles. Each man wore sandals or clogs, which were taken off and left on the board should he have occasion to leave it. When returning to work on the chopping board the sandals had to be resumed. This was the precaution taken to ensure that no contamination was taken from outside. These quaint articles of working paraphernalia have all now disappeared. At the taking of the (what I might call) middle-year samples they were sent down to the Laboratory by cart at the end of each day. Bigg would, next day, assisted by two or three boys, break the soil up into small lumps, dry at gentle heat, and re-bag, placing them by until the

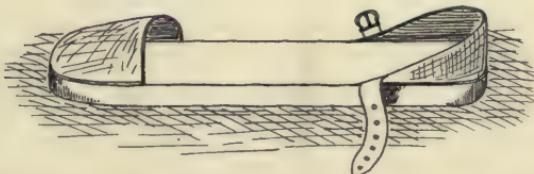
-OLD APPLIANCES FOR BREAKING UP SOIL SAMPLES-



(1)

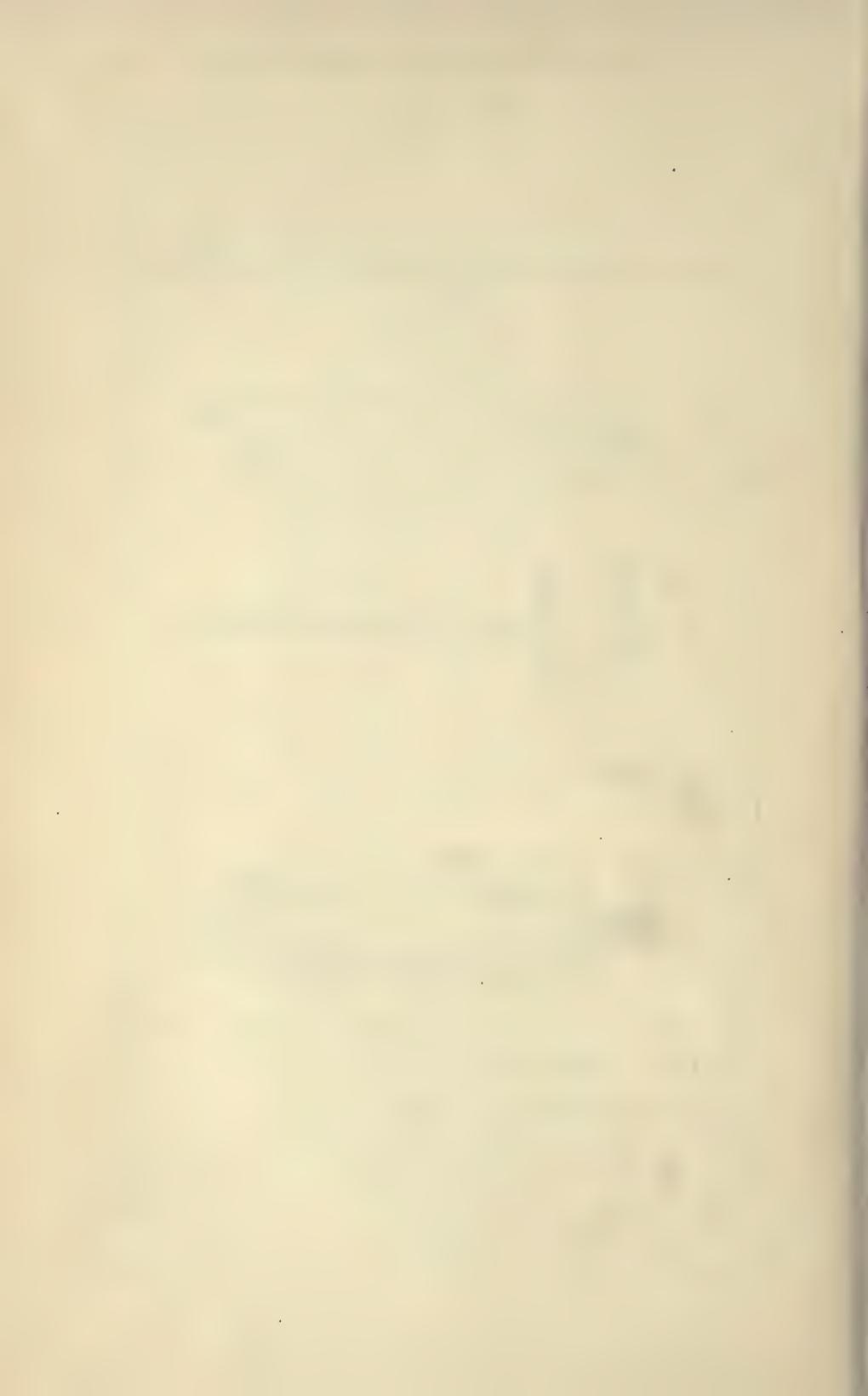


(2)



(3)

- (1) SOIL CHOPPING BOARD
- (2) FOUR BLADED SOIL CHOPPER
- (3) SANDALS USED DURING SOIL CHOPPING



whole were finished. Then Willis, I, and sometimes four or six boys, each with mortars, would be for weeks at the final preparation and weighing up for stock and analytical work.

In the deep-depth sampling of Agdell Field in 1883-4, some of the holes were left open for some time, so that Mr. Warington could take samples for his nitrification investigations from the earth at the sides at various depths. I assisted him in this, and I can well recollect the proceedings. At the appointed time we would sally forth, Mr. Warington carrying one tray on which were his bottles of prepared solutions, closely plugged with cotton-wool. I carried another tray on which was a spirit-lamp, a foot-rule, a spud, platinum spatchelors, and other things. Arriving at the holes, the operation became exceedingly serious. Mr. Warington assumed a most solemn and serious mood, and we descended by means of a short ladder into the hole. The correct measurement having been taken and the exact spot indicated, the lamp was lighted, the outside soil scraped away with the spud ; the platinum spatchelor, after being heated and allowed to cool, was then used to scoop out a small hole deeper into the soil. Finally another very narrow platinum spatchelor was brought into use ; this had to be heated and cooled twice. When cooled a small lump of soil from the inner recess of the scooped-out hole was obtained. At this moment I had the proper solution ready, and kept the bottle as near his hand as possible, so that when he withdrew the spatchelor with the little lump of soil adhering, I unplugged the bottle, the soil was deposited in the solution, and in the twinkling of an eye the bottle was re-plugged, and there you are ! This was all done in utter silence, and hardly breathing. I am afraid I did not at that time realise the importance of the investigations. I know I had to bite my tongue, the solemnity and seriousness of the affair struck me as most comical.

A trial was made with a large screw cylindrical soil-sampling machine. I recollect just seeing it, I think it was in 1878. It seemed to me a very lumbering affair. I have been told men worked it by turning a handle, something like heaving a boat ashore at the seaside. It was to overcome the flint difficulty, but it did not, and was soon discarded. A few samples were taken by it from Agdell Field. Of late years a small crushing machine has replaced the iron mortars, and a 3 mm. sieve that of the $\frac{1}{4}$ ".

RAIN AND DRAINAGE SAMPLING.

Having several times mentioned the rain, drainage and mangold sampling, I think it would be as well at this part of my narrative to explain the methods taken. With regard to the rain and drainage, Barnfield, Mr. Warington, as before stated, introduced the proportional sampling according to the fall of rain or the amount

of percolation. For every inch of rain a gallon of the water was taken, for a tenth of an inch a deci-gallon, and so on. The drainage water sampling being on the same principle. Large carboys (in skips) with numbers painted on, weighed empty, were used for this sampling. The proportional part (whenever any rainfall or percolation was registered) was measured and put into these carboys, and so kept until the end of the month. They were covered and kept dark. At the end of the month they were weighed, well shaken up, and final samples taken from them. Mr. Warington would bring out his book and take down the weights ; these, of course, should be in exact proportion to the amount of rainfall or percolation. By this means he would know if I had made any mistake in my daily proportional sampling. I never heard of any, so I suppose all was well. A Winchester quart sample from each, when available, was the final taken. These bottles had always to have two rinsings before being filled up. Mr. Warington and myself did all these final samplings, and later on Dr. Miller continued them in the same manner as Mr. Warington.

BROADBALK DRAINAGE WATERS.

The Broadbalk drainage waters were sampled differently to those of Barnfield. In this case, whenever possible, a measured quantity was taken every three hours or thereabouts, a glass half-pint measure being used. For a full day's sampling the hours were generally 7 a.m., 10 a.m., 1 p.m., and 4 p.m. These four samplings were put into a stoppered quart bottle, and so made one sample for the day for each individual plot, the samples being taken from the water issuing direct from the pipes. Each bottle had a wooden label tied round the neck whereon was the plot number and date. Frank did the sampling from the Broadbalk field, and also took an account of the size of the flows from the various pipes at the time of samplings. For the description of the size he had his own unique method. This began at dropping, then came dribbling, straw size, pencil size, size of little finger, mid-finger size, thumb size, then two middle fingers, and lastly half the size of the pipe. Frank was able to write a bit, and I think read a little, but I have never seen him write on paper. He could make fairly good figures, and would put down at the different hours the size of the runnings, but for this purpose he always used narrow slabs of wood, never paper, nor did he ever note anything in a book that I know of. Frank would generally cut these wood slabs from the hedgerows, mostly hazel-nut, because that wood was easy to get a smooth surface upon ; these slabs would also be pretty thick, so that when one lot of figures were done with they could be cut off and the wood used over again. He would put down his figures in a row on the wood, and to denote the volume of the

flow would put a queer assortment of marks, dots or dashes above each plot number, and only he knew what they meant. When Willis or I had to take down the description from his dictation, he would readily read off these mysterious symbols. On wet Sundays, also, Frank had to go and take the four samplings. He told me he missed his afternoon service at the church. He used to call these wet Sundays "Susan's Sundays out." In the winter time there was often a tremendous accumulation of these drainage samples; all had to be brought down from the field to the Laboratory by barrow, and I recollect when Frank told Sir Henry that he thought they ought to get a little cart to bring them down and have an experimental donkey. Sir Henry's answer I remember very well. He said, "Well, Frank, we've already got one or two about here now."

All these samples were kept in dark cupboards, and at the end of each month, or before if excessive drainage, a grand mixture was made. Sir Henry, Willis, or myself, sometimes all three of us, would have quite a long sitting over it. The size of the flows, the tables of runnings, the description of the weather at that time, all had to be taken into consideration before Sir Henry would decide how much or how little of each individual sample should be taken to make the final grand mixture.

The present brick trench, built in 1896 or 1897, was a great improvement. Before that the pipes from the plots discharged their water into large circular holes, one for each pipe. A little gutter cut at the back of each hole led into a larger gutter, which carried the overflow away. In continuous wet weather these holes remained almost full of water, with only a little distance between it and the plot pipe, sampling at these times being a most miserable job.

ROOT SAMPLING.

The sampling of the roots from the Barnfield was always an active time in the Laboratory. For many years samples were taken from every plot each year, and dry matter, ash, nitrogen, and sugar determinations made in each sample. Usually this sampling was done just before the crop was lifted, the whole sampling operation being completed before the actual lifting began; at other times, when a spell of severe frost was feared, so many roots were taken from each plot, roughly trimmed, weighed, and put by in a cool place (usually the Well House) until the crop was carried, when the sampling operations were then proceeded with. Frank or, later on, his son, Alfred, drew the samples, choosing, as far as could be judged, average sized roots, according to the plots from which they were drawn. The number taken from each plot varied according to the size. If very large, 15-20 would be taken; smaller, 20-30; very small, 50 or more. A barrow load,

probably three plots, would be brought from the field at intervals and taken into the Laboratory one plot at a time. The leaves would be cut off and the roots roughly trimmed and weighed. The leaves also were weighed, washed, dried, and re-weighed, the dead or decayed being first picked out and weighed separately. The stems of the leaves were then slit into strips for quicker drying, and the whole labelled and put into the drying-room. Whilst the leaves were being attended to, other men were preparing the roots ; they were weighed, roughly trimmed, the worst of the adhering soil removed, and again re-weighed. They were then thoroughly washed and scrubbed, first in rain water from the tap, and finally in clean well water, afterwards wiped as dry as possible with cloths, and the final weight taken. When this part of the proceeding was finished the roots were arranged in a row upon one of the benches. If Sir Henry was not in the Laboratory, someone was despatched to let him know that a lot was ready for his inspection and noting. Now this was really a most momentous business ; supposing there were 50 roots, he would pick out the highly coloured and put them by, then the pear-shaped, round, etc., etc. When this sorting out business was accomplished to his liking, the noting began. Mr. Willis would be at hand with pen and paper, and would take down as Sir Henry dictated. "Are you ready, Mr. Willis ?" "Yes, sir." "Let's see, what plot did we say this was ?" "4-0." "Oh, yes ! 4-0, well put down—ten roots of a bright orange colour, rather long and tapering in shape ; 20, more round and of a paler colour ; 15, uneven, irregular roots ; 5, somewhat larger than the rest, pear-shaped and pale colour. Taking the sample as a whole they appear to be rather smaller than previous years." From the highly manured plots his description of the roots would be more condensed, thus, "10 large nice shaped roots, 5 more irregular, with coarse crowns, 5 medium sized, more colour than the others," and so in similar manner each sample of roots were noted upon. The leaves were seldom noted. During this noting, etc., of one plot, the washing and preparing of another was being proceeded with, and would probably be ready by the time the first was cleared away. I often had heard Mr. Willis say to Frank, when bringing in a sample, "Now are you sure they are representative ?" Being curious to know what this oft-repeated phrase meant, I asked Willis, and he told me the following incident. One day the sample roots from a certain plot had been washed and arranged for Sir Henry's inspection, and Frank was getting on with another lot, trimming, etc. Now Sir Henry on this particular morning was in rather an unamiable mood. "What plot is this, Frank ?" said he, as he came in. "It's so and so," said Frank. Sir Henry, looking at them, said, "They are not at all representative." "It's as well as I can pick'em out," said Frank. "It's not a representative sample at all, you must go and fetch another lot ; I will be back again shortly," said Sir Henry. Frank in the meantime stayed to

finish the lot he was doing before going to fetch a fresh lot, and so before he got away Sir Henry came in again. The disputed roots were still lying on the table. (I was not told if they had been moved at all.) Sir Henry, thinking they were fresh roots, said, "Now, Frank, these are much more representative of the plot." "Why!" said Frank, "they're the same lot, I aint 'ad time to fetch no more yet." When the roots had been noted upon they were passed on for the next operation. They were now divided, each root being cut in halves, quarters or eighths to the exact weight. A certain proportion was taken for dry, ash and nitrogen, and a certain proportion for pulping. That for dry matter, etc., was cut into slices, threaded upon strings, labelled, and tied across from iron to iron in the drying-room. All this part of the proceeding was done in the back laboratory, the pulping and juice extractions being done in the front. The proportion for pulping was taken into the front laboratory, where four men generally did the pulping and juice extractions. For the pulping purpose large circular graters (nutmeg grater shape) were used, and the sections pulped into large enamelled dishes, each man having so many sections to grate up. When ready the pulp was weighed, put into linen bags, two, one inside the other, as much juice being squeezed out as possible by hand before putting into the iron presses, large porcelain basins with lips were placed under, and the pressure gradually put on. The bags were taken out from time to time, the contents shaken up and again returned to the press; by this means as much of the juice as could possibly be got was extracted. It was emptied from the basins from time to time into large bottles with stoppers of glass, the bottles being weighed empty and again with the extracted juice. Mr. Willis had charge of the polariscope, and Sir Henry and he did the sugar determinations. Knott attended to the weighing out and evaporating of the juices for dry, ash and nitrogen, whilst I attended to the weights and dividing of the samples, etc., and King or Bigg looked after the drying-room and things generally. It can be easily understood that these operations employed quite a number of hands. There were generally six, sometimes more, from the farm, besides ourselves at the Laboratory. All those from the farm were allowed a pint of beer at dinner times. They generally called at the little public-house just above for the beer, and Sir Henry would settle up at the end of the week. I remember one day that a man named Saunders, who was one of the pulpers in the front laboratory, went off to his dinner at 1 o'clock, leaving some of the sections unfinished and his dish of pulp uncovered. The other men had finished theirs and covered their dishes up. Sir Henry came in just before 2 o'clock, and noticing how the sample was left, was very angry about it. He enquired who had left it in that state, and was told Saunders. When he entered the room Sir Henry said, "Where have you been, Saunders?" "I've been to 'ave me dinner, sir."

" And left your work like that ! You shall not have any beer." " But I hev'ad it," said Saunders. " Then I will not pay for it," said Sir Henry, " you will have to pay for it yourself."

The samples of dry matter, ash and nitrogen were continued up to the time of Sir Henry's death, but the pulping and determination of sugar were after some years either discontinued or only occasional samples done. In the year 1895 another method was introduced, that of the estimation of sugar in water extractions of pulped roots ; sometimes both methods were used. At this time a new rasping machine was introduced by Dr. Miller ; the same was used for all pulping operations from 1895 onwards. It is intended for sugar beet, being somewhat narrow for mangolds. But we got over this difficulty by cutting off a portion from each side of a fat mangold until it fitted into the guiding slot of the machine. A circular rasp is provided for the machine, and as the root is pushed along and the rasp turned, a section of the said root, a tenth to a twelfth, is rasped out, from the snout to the crown, the pulped section thus taken out being deposited into a receptacle provided for the purpose. When wanting to extract the juice, a little hydraulic press was used, the old presses by this time having been cleared out of the front laboratory. From 1895 onwards the sugar estimations were now generally done by Dr Miller, sometimes by Mr. Lawrence.

Whenever a number of men from the farm were working on this mangold sampling job, some very queer tales were told among them. I remember one late season during a very severe frost we were working with stored mangolds, a man named Ivory said he recollects when there were six weeks' frost one February. On another occasion, on a 5th of November, the men were discussing as to whether the old custom of " Membering " (as it was called) ought to be kept up. Some were for it, some against. A man named Brazier said that he was sure it ought to be, because it said about it in the Bible. I expect that the first man, Ivory, meant that the period of frost extended over the whole of February and well into March, and the man Brazier, I fancy, was thinking of the form of prayer to be used for the 5th of November, which, I understand, was inserted in old Prayer Books.

SUPERPHOSPHATE MAKING, ETC.

One of my first duties, when trusted to attend to any duty alone, was to superintend and check the weights when making the superphosphate. At that time all superphosphate required for the experiments was made at home, being made in the thatched barn at the back of Rothamsted Lodge. It was made in a long iron trough like a cattle drinking-trough. So much bone dust and so much sulphuric acid were weighed out. They were mixed and

stirred until set sufficiently to take out of the trough, and a heap of the mixture was made on one side. Then another lot was mixed, etc., until sufficient for our purpose was obtained. The heap was then left until sufficiently dry and fit for use, when I again went to the barn and re-weighed the bulk. Frank, with another man helping, always did this mixing. We always kept a vessel of water close at hand, and also had the little door opening on to a pond always open, in case of splashes or any accident with the acid at any time, so that we might wash immediately.

The rape cake also was ground into dust at home here, the cake coming to us in the ordinary slabs. Two enormous circular stones were used for this purpose, one lying flat and the other on edge, fastened to a spindle in such a way that it could be rolled over the flat one, being pulled round by a horse. As this stone revolved over the other the slabs of cake were pushed underneath it and so crushed, the crushed stuff being sifted from time to time and the coarse returned under the stone again, until all was rendered fine enough for our purpose. Frank, his son Alfred, and a man named Rowe attended to this work. They also, during the winter, made huge fires, where earth clods were burnt to provide sufficient earth ashes for mixing purposes when making up the manures to certain bulks. Of late years ashes from the laboratory furnaces have been used for this purpose.

MANURE SOWING.

Even manurial application has always been from the very first more or less a difficulty, mostly on account of the wind. In windy weather I have known Sir Henry stop the sowing, and he has had the manure taken back to the shed, waiting sometimes a week, or even more, for a favourable opportunity for sowing.

King invented a sort of wind screen ; it was in use a very little while. I was told the screen consisted of a wooden frame, the width of the Broadbalk plots (they were a bit wider then than now) and about 8 feet high. It was covered with canvas on the sides, back and front, a door in the back being arranged for the sowers to enter, the whole frame being of sufficient length to allow four men to sow two and two. It was mounted on wheels and drawn by a horse. One day when the manure sowing was in progress a sudden and strong gust of wind caught the screen, lifting it off the ground, dashing it sideways to the earth, where it fell and crashed up. The men inside escaped injury, but that was the end of that. Afterwards side-wind screens, light wood, canvas-covered frames were carried, one on either side of the sowers. They were about 15 feet long and 5 feet deep, with a flounce of canvas at the bottom, just reaching the ground. The top pieces of wood projected at either end, so that the screens could be carried on

men's shoulders, a handle for steadyng purposes being provided at either end about half-way down the screen.

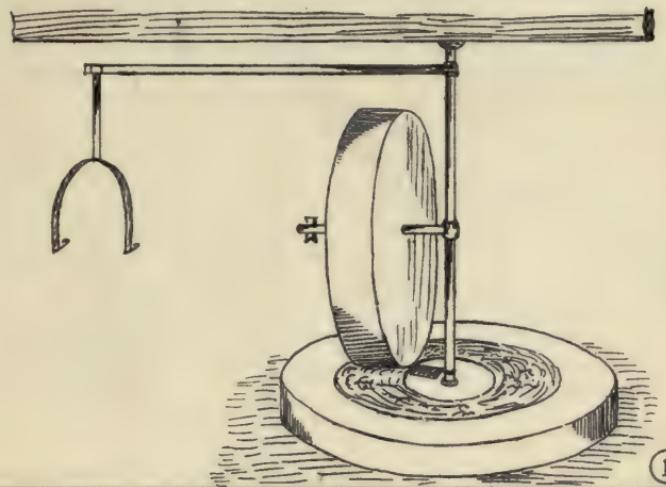
When the plots were to be re-ploughed there was generally a furrow up the middle of the land, and to ensure that no extra manure was deposited there, long narrow wooden troughs were provided, with rope attached. A man would place the rope over one shoulder and draw the trough along the furrow, keeping pace with the sowers, so that all manure which would have fallen there was caught in the trough. From time to time the contents of the trough were emptied into the men's sowing scuttles ; and so when the land was re-ploughed that soil turned into the furrow had received its proper amount of manure.

This was the process in use when I took over superintendence of manure sowing. Mr. Willis doing the mixing in the manure shed, my duties were to see that the plots received each their proper bags of manure, and also that each man had about the same amount of manure in his scuttle. This was necessary, because one man had a larger hand than another. If not measured out, he with the larger hand would probably use up his lot quicker than the man with the smaller hand, but if measured out to sow a certain distance, each would have to gauge their handfuls accordingly.

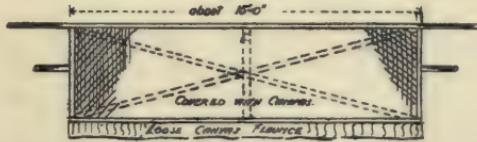
As time went on good manure sowers began gradually to die out, and a manure distributor was then obtained, "Ooulter's Manure Distributor" being the make chosen. Mr. Alfred Freeman took over this machine and saw to the working of the same. It does its work very well, and the wind difficulty is more or less overcome in windy weather by fastening a cloth or bag on to the back of the machine so that they just clear the ground, the falling manure is greatly protected and falls fairly evenly over the soil.

At about this time Mr. Willis was taken seriously ill with the complaint from which he never really recovered. I had to take his place in the manure shed, leaving Freeman entirely in charge of the distributor. This duty of manure weighing and mixing I have continued up to the present time. The manure shed in the earlier time was a large ramshackle old barn standing at the farm near the coach-house. The coach-house is still standing. I think the present approach to Rothamsted House passes right over the spot where the barn used to stand. When it was pulled down the manures were brought down to the laboratory and placed in the new manure shed. This was an exceedingly neat and compact building, compartments being made to store each sort of manure separately, with label indicating the name of the manure therein placed above each compartment. One of the large circular stones from the old manure shed being embedded in the floor, whereon any breaking up could be done if wanted. The plans for this shed,

—OLD APPLIANCES USED AT MANURE SOWING—



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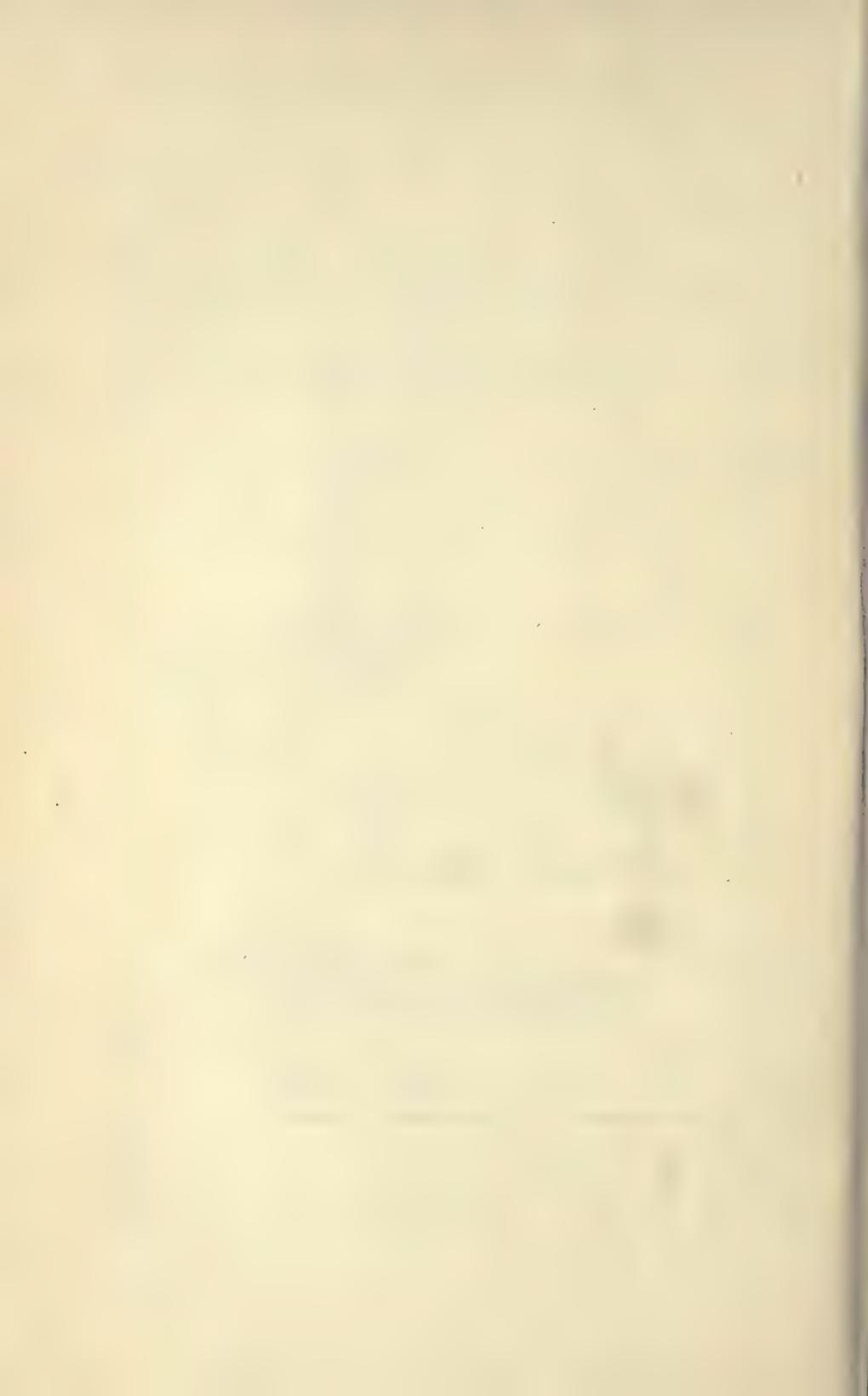


③

① CRUSHING STONES - FOR BREAKING UP MANURES

② WIND SCREEN - USED AT MANURE SOWING

③ MANURE TROUGH



and also for the new chaffing shed mentioned earlier, were drawn up by Mr. Willis, and the places built during the time Dr. J. A. Voelcker was director *pro tem.*

NITROGEN FIXATION.

Many experiments were made and much work done from 1888 to 1894 on the fixation of free nitrogen, leguminous plants being grown both in pots and in pits. Most full and lengthy notes on the conditions, growth, flowering, etc., were taken frequently by Mr. Willis or by myself. At the laboratory the work of washing the roots, mounting for photographing, etc., took up considerable time. On some the nodules had to be counted, on others, counted, picked off, and prepared for analysis, etc.

The pits were constructed of movable slates, and when extracting the growing plants from the sand or soil most careful handling of the same had to be exercised, and the soil or sand searched thoroughly, in case any nodules may have got knocked off during the lifting. Every plant was mounted and photographed, thus ensuring an enormous lot of tedious work ; but this subject will be spoken of again later on in my narrative, and will be dealt with more fully there.

ASH MIXTURES.

Mixed year samples of the ashes from the various plots of the experimental fields were made from time to time. The ash samples required were taken from their shelves and the bottles arranged in order on the bench for Sir Henry's inspection. Each sample was examined, and if all was well, were re-heated, re-sifted, and so many grains weighed out from each sample, according to the produce of that particular plot and year. The whole of these various weighings were then thoroughly well mixed, and a certain quantity weighed out from it, bottled up and numbered, to be despatched to Mr. Richter, at Charlottenburg, for analysis. Only a number was put on the bottles despatched, so that Mr. Richter did not know which plots the ashes were from. A duplicate sample was also kept for the laboratory. The greatest care was always taken at these mixings, Sir Henry himself generally being present.

TABLES, DIAGRAMS, ETC.

Sir Henry Gilbert cared little for charts, but delighted in columns and columns of figures. Many stencilled tables were made for his use in explaining results obtained in the various experiments.

When Professor of Rural Economy in 1884-90 at Oxford, and also when at Cirencester, we had a tremendous number of these tables to make. Some he took with him when going to Oxford, or wherever it was, others had to be finished and despatched to him by post or rail. For his American lectures also a great many were made and despatched across the sea.

I recollect also for the Chicago Exhibition, 1893, we had to make some enormous tables of figures. They were so large we could not find space enough at the Laboratory to prepare them, and so a very large empty room was hired at the hat factory for the purpose. We had to use the floor to work on, the calico being stretched on the floor, and to wear carpet slippers whilst working. As these tables were finished they were hung up, figures read over and checked. These American ones were so large they had to be hung outside the Laboratory and on the outside walls of the Sample House to be read over. When all were completed they were rolled round a long pole, covered and bound over, and so despatched. I used to wonder what this exceedingly wide calico or white union was used for, and found that this material is used for the painting of the scenery at theatres.

CORN VALUATIONS.

During the years 1899-1902 valuations of the wheat and barley grain from each plot of Broadbalk and Hoosfield were made by Messrs. Hewlin & Few (corn experts). A sample from every plot was placed out for inspection. These samples were numbered so that the judges knew not from which plot the samples were taken. I believe, so far as I can recollect, that the superphosphate plot, 2-0 barley, was nearly always picked out as the best quality, and I think generally plot 13 (^{s/ton}, super and potash) was chosen as one of the best quality from the Broadbalk wheat plots. I remember Sir Henry telling Sir John in a joke that these judges could tell the difference between two peas when both were alike.

NITROGEN WORK.

When Lawrence left, Dr. Miller suggested that I should take over the nitrogen work. Sir Henry consented, and Dr. Miller taught me the method. From that time onward I did all the nitrogen determinations. If I was in doubt, or had difficult samples to deal with, on appealing to Dr. Miller he at once came and advised me how to proceed, pointing out where I was wrong, and so on. I continued at this work for ten or eleven years, during the whole time Mr. Hall was Director, and during the first years

of Dr. Russell's Directorship. When Mr. Willis became seriously ill and could no longer attend to the field work, I had to take his place entirely. I found that it was impossible to attend to all these duties properly, both in the field and at the Laboratory. Sometimes, just as I had started combustions, or was in the midst of a batch of distillations, word would come for me to go to the farm at once. I then had to do the best I could. Sometimes Dr. Miller would finish them off for me, at other times one of the other chemists, but at times they were completely spoilt. With the meteorological records I had the same difficulty, I was at the farm, and ought to be at the gauges ; but in this case I generally managed to leave word with someone in the Laboratory to go and take the records, at other times I have taken my breakfast and eaten it as I went along from the farm to the gauges, and then got back again to the farm by the time the men were ready to start work again after their breakfast. On finding that I had more jobs on hand than I could satisfactorily manage, I asked assistance, so that if called away I could safely leave the nitrogen and other work going. It was in answer to this appeal that W. Game came on the staff. I trained him in the nitrogen work, and so felt safe to leave him on this work after a time. I also trained him to take the meteorological records, so that when I was called upon to go out more and more into the fields and to take visitors round the experiments, etc., I could leave Game entirely on his own to do the work.

I might say, in passing, that Sir Henry never allowed us to do our own calculations. The figures had always to be taken into the office to Wilson for him to calculate. When Mr. Hall became Director we were allowed to work out our own calculations, and the logarithm tables were introduced, the figures afterwards being checked by Wilson. If the duplicates agreed within a certain figure they were passed by Mr. Hall, if not, repetitions had to be taken.

THE JUBILEE.

Saturday, July 29th, 1893, was a red-letter day in the annals of the Laboratory, for on that day was celebrated the Jubilee of the Rothamsted Experiments.

A huge granite boulder, suitably inscribed, with base of the same material, had been placed in position in front of the Laboratory, and a large marquee had also been erected on the lawn in front for the accommodation of the visitors. A large and distinguished company assembled for the occasion, many travelling down from London by special train on the Midland Railway.

The Rt. Hon. Herbert Gardner, M.P., presided, and many well-known and titled people and scientific personages, chairmen of most of the Agricultural Associations, of the Royal Agricultural Society, the Chemical Society, Linnean Society, and many others were there. Addresses from the R.A. Society of England, the French Agricultural Society, the Chemical Society, the Linnean Society, and also from several of the foreign Agricultural Societies were read.

These, together with the Chairman's speech at the dedication of the boulder, and many other speeches, also other most interesting matter is given fully in the Report of the Executive Committee, Rothamsted Jubilee Fund. The Duke of Westminster, as Chairman of the above Committee, presented to Sir John his (Sir John's) portrait, which had been painted by Mr. Hubert Herkomer, R.A. This same portrait now hangs on the wall at the entrance to the Library (on the left). Sir Henry, on behalf of the subscribers, was also presented with a silver salver. Many letters and telegrams regretting inability to be present were received.

We at the Laboratory, or, at least, most of us, did not see or hear so much of the proceedings as we would have liked. We were all kept very busy attending to the comforts of the very numerous visitors.

MR. A. OGGELSBY.

In April, 1901, A. Oggelsby came to the Laboratory, filling the vacancy caused by Bracey leaving. He did but little of the grinding and preparation work, being soon transferred to other branches. Oggelsby and I are the only ones now working in the Laboratory who were here in the late Sir Henry Gilbert's lifetime. I for the length of 29 years, and Oggelsby for about eight months.

VISITORS—HUMOROUS TALES.

During my many years of service I have seen numerous visitors to the station. I should think persons of all nationalities have visited at one time or another. A great number of Americans and people from our own colonies have made it a point when in England to visit here before returning home again across the seas. I recollect one very picturesque figure paying a visit in my early years. It was that of a Chinese Mandarin or person of very high degree. He was the first living Chinaman in native costume that I had seen. I think his dress was blue with a little black jacket, white soled shoes, a queer shaped hat, his pigtail being of great length. This exalted personage was accompanied by his suite and

also an interpreter. I thought his costume was a very gorgeous affair. I recollect quite distinctly seeing him, Sir Henry, and the interpreter strolling about on the grass in front of the Laboratory, the attendants following close at hand. Often there were single visitors or parties of four and five, but more often they came in large parties from the various Colleges and Agricultural Institutions.

When a large party was expected it meant a busy time for the Laboratory the day previously. Sir Henry would then come up fairly early and decide what subject he would speak upon. (There was always a little lecture in the Laboratory before departing for the inspection of the plots in the fields.) When he had decided upon it, any tables bearing on the same were brought out and fastened on to the balusters round the gallery, so hanging down into the room below. These were arranged in the order Sir Henry would indicate. The parties would arrive about 10.30 or 11 a.m. As soon as they arrived someone was despatched to the house to let Sir Henry know of their arrival. In due course he would enter the room, and after introductions were over would commence his lecture.

Mr. Willis, with a long pointer, would be in the room below, whilst Sir Henry would speak from the gallery above. As certain columns were referred to, Willis would point out the same, and so indicate the figures as the lecture proceeded. At the end, amidst the applause of the assembly, Sir Henry would descend and again enter the room. He would then ask Mr. Willis to explain the grass case. Whilst this was going on he would go down home and refresh himself—with a cup of bovril generally. Being thus refreshed, he would again appear at the Laboratory, this time with coat, umbrella or stick, according to the prevailing weather. He and the visitors would then depart for the fields. Willis always accompanied him on these occasions, carrying Sir Henry's hand-notes, etc., and at the various fields hand up whichever note was asked for.

A boy named Luck, one of the grass pickers, one day was sent to catch up the party, taking to Sir Henry a paper he happened to have left behind. When Luck returned we asked him how the party was getting on. He said, "I caught 'em up in Agdell Field, and Sir Henry got up on the seat there, and then 'e got 'em all round 'im, and 'e didn't arf let 'em hev it."

I remember one day when about to go round with a party, Sir Henry found that he had forgotten his gloves. He asked me to run down to the house for his old gloves (this was whilst he was Dr. Gilbert). I hurried down, and Lady (then Mrs.) Gilbert met me at the door. In my hurry I asked for the "Old Dr.'s gloves." I noticed her look of astonishment, and realising my mistake, I apologised, saying I had put the cart before the horse.

Sometimes the parties were very large. When all have been inside the Laboratory there has been scarcely room to move. At all these parties Sir John always provided luncheon, and nearly always in the fields near the plots. Sometimes I have known, when a large and distinguished party were being conducted round, a large marquee for the luncheon being placed under the oak trees on the lawn, or in the pleasure gardens of Rothamsted House ; at other times the marquee has been placed near the grass plots, or at the bottom of Broadbalk under the oak trees there. The proprietor of the Railway Hotel in the village always supplied the luncheons on these occasions.

During the war naturally visitors have been fewer and the parties smaller, but since the cessation of hostilities the visitors have been more numerous, particularly colonials and Americans, who have taken advantage during their stay in England to visit this world-renowned station.

Since Mr. Willis's death I have conducted a good many visitors round the plots, and some have been very amusing in their remarks. Last year I was showing round a young colonial, I think he was an Australian. He was very enthusiastic, and seemed to greatly enjoy seeing the actual plots. "Do you know," he said, "I have read all about Rothamsted, and I have so longed to see this station. I have thoroughly enjoyed this visit, and I am so sorry I cannot see Sir John Lawes to thank him personally for all he has done for agriculture, but when I get to Heaven I daresay I shall run across him, and I shall certainly then offer him my thanks. Why ! everybody in this country ought to contribute to the funds, and ought to be jolly glad to do so too ! "

In the early spring of this year I was taking a young Japanese gentleman round. He was an exceedingly pleasant young fellow. As we were passing the Allotment Club House he asked me what the building was. I told him that it was built by Sir John Lawes, and was for the use of allotment holders, where they could sit and smoke their pipe, have their glass of beer, and talk over their garden affairs. He replied, "Yes, so, yes, that is very clever." When we reached the grass plots, rolling had taken place the previous day, and according to the way the roller had passed, up or down, so the herbage looked either light or dark, as is always the case after a rolling. He enquired, "Was it the manure ?" I tried to tell him it was the rolling did it. I couldn't quite make him understand, so I took his arm and turned him round, pointing again to the roller marks. Of course, looking a different way the colour of the strips was reversed, so then he understood. He laughed most heartily, and waving his hand said, "So to, so back, oh, yes ! I see, one that way, one back." Going a little further along we came across a freshly turned mole heap. He asked what it was.

I told him it was caused by a little animal that lived underground in the soil, and was called a mole, and that as it burrowed its way along just under the surface it threw out the soil behind it. He said, "Oh, yes! little animals, rabbits!"

DIRECTOR *pro tem.*

From the time of Sir Henry's death until the appointment of Mr. A. D. Hall, the directorship *pro tem.* was taken over by Dr. J. A. Voelcker, director of the R.A.S.E.'s field experiments at Woburn, and also a member of the Lawes Trust Committee.

PART III.

THE NEW ERA.

1902-1912—Mr. A. D. HALL, F.R.S. (now Sir Daniel Hall),
DIRECTOR.

1912 ONWARD—Dr. E. J. RUSSELL, F.R.S., DIRECTOR.

RESEARCH WORKERS, 1903.

THE JAMES MASON LABORATORY, 1906.

RESEARCH WORK AND WORKERS (Dr. RUSSELL AND OTHERS),
1907.

ROYAL AGRICULTURAL SHOW EXHIBITS (PARK ROYAL), AS SENT
BY MR. HALL.

MR. HALL BECOMES F.R.S., 1909.

ADDITIONS TO STAFF, 1910—W. PEARCE, B. WESTON.

AMERICAN VISITS.

CONVIVIALITY, CHRISTMASTIDES, ETC.

MISS BRENCHLEY BECOMES D.Sc., 1911.

THE NEW WING, 1911.

STEWARDS, 1872-1922.

MR. HALL'S RESIGNATION, 1912.

DR. RUSSELL APPOINTED DIRECTOR, 1912.

ADDITIONAL RESEARCH WORKERS, 1912.

OPENING NEW WING, 1913.

OTHER RESEARCH WORKERS, 1913.

THE NEW FARM BUILDINGS, 1913.

ROYAL AGRICULTURAL SHOW EXHIBITS, BRISTOL, ETC., AS SENT BY
DR. RUSSELL.

SIR HENRY GILBERT'S LIBRARY, 1913.

DEMOLITION OF OLD LABORATORY AND ERECTION OF THE NEW,
1914-1918.

THE GREAT WAR, 1914-1918. THE SUPREME SACRIFICE MADE,
HONOURS WON.

MR. A. FREEMAN (1875-1915).

OFFICIAL OPENING OF NEW BUILDING, 1919.

THE Rothamsted LABORATORY, 1890. FRONT LABORATORY AND GALLERIES.



PART III.

THE NEW ERA.

In 1902, Mr. A. D. Hall (now Sir Daniel Hall), previously Principal of Wye Agricultural College, Kent, was appointed Director of the station. And here I might write the words, "the old order changeth"; but by this phrase I do not by any means impute that less care was taken in the working of the experiments. The same careful supervision was given as formerly, but newer and more up-to-date machinery was introduced on the Farm, whilst in the Laboratory itself new research work and new investigations were undertaken, more activity and life being infused.

The interior of the building was improved and made more comfortable, and as far as possible made adaptable for the changes of method of work now introduced.

The bare and unsightly floors were covered with linoleum, whilst for warming the building effectively, a steam service (with radiators in the various rooms) was installed; the large central stove in the front Laboratory being taken out.

The water and gas services were also carried into every room where needed, the old-fashioned water-taps being replaced by those of the new type, called pressure taps.

A new lead-covered bench was also placed across the centre of the front laboratory, with water and gas taps conveniently placed upon it. This bench proved very serviceable, and was always in constant use by the research workers and others. The old calomel chest, and the grass case, so often mentioned in my narrative, were now removed, the former into the Back Laboratory, and eventually into the Sample House, the latter into the Sample House direct.

In the place of the chest, another lead-covered bench was provided, whereon was placed the old, and also the newer hot water drying ovens, whilst on the south wall, in place of the grass case, a bench to carry the old and the new small balances was fixed, and was called the Balance Bench.

In the Kjeldahl room, additional benches and distilling apparatus were added, and the fume cupboard, with its digestion apparatus,

removed to the Back Laboratory, where it was enlarged and made into two compartments, additional digestion apparatus being provided for it.

The old Sand Bath in the Front Laboratory (mentioned in my earlier notes) was now made into two compartments and used by the chemists as fume cupboards. One of the two side rooms on the south were also fitted up as a small laboratory, and used by the research workers during their investigations.

The hitherto bare floor of the Library was now covered with a suitable carpet, better seating accommodation was provided, and the room used by Mr. Hall as a study.

The back laboratory was also altered, suiting it to the new requirements. The old iron drying oven was taken away, a dividing wall with glass lights along the top being built in its place, thus converting the furnace room into what was now called the boiler room. Here was placed the new upright boiler which supplied the steam for warming the Laboratory ; a steam supply from it being also carried through the ceiling into the drying-room above, the old drying stove being no longer used. Gas lights were also placed at the south end of the gallery, and tables fixed. Here the botanical and other work was now carried on. A large steam drying oven (copper) took the place of the old iron one in the back laboratory ; this same steam oven being now in use in the present ash room, and still used for the same purpose.

The present large glass house and wire cage, now in constant use for pot work, with its accompanying trucks and rails, together with the smaller house at the side, were erected in the early part of Mr. Hall's directorship. These structures are now as then, save that the site and position was altered when the present Laboratory was built. Before then, the glass part of the structure was eastward, the wire cage being west ; when re-erected the position was reversed, and the site moved more to the south. Bigg had charge of the heating arrangements of these houses. He also, in addition to his other duties, now took over from me the sampling of the crop samples from the Experimental Plots as brought to the Laboratory, sampling in the same manner as myself, viz., for stock, dry matter, ash and nitrogen ; my own time being now fully taken up with the meteorological records, field work, and nitrogen determinations in the enormous number of samples now being passed through.

RESEARCH WORKERS.

The whole place, in comparison to early days, began to wear an air of great activity. Many young men coming in as research workers, others as voluntary workers. They stayed on generally

for a couple of years or so, and then passed on to other spheres of labour.

It fails me to recall the names of all these young men, but of all of them I have most pleasant memories. Many now bear well-known names in the scientific and agricultural world, and hold important positions in those institutions of our own country, in our colonies, in America, and other parts of the world.

Of the many young men who came into the Laboratory at this time I recollect the first two were Ashby and Carter ; following them came A. Hutchinson, Amos, Morison, Atkinson, Watt, Gimingham, Harper, Mar, and Mercer, and then Vipond, Knowles, Petherbridge, Hanley, Campbell, Dr. Hutchinson, Daish, Davis, Prescott, Clayton, Goodey (now Dr. Goodey), and others. Only one of these young men at the present time is with us—Dr. T. Goodey—who after an absence of some few years has again returned to us, having in the meantime won well-deserved honours ; of the others, some, alas ! are not, and the rest are scattered far and wide.

In October, 1906, Miss Brenchley (now Dr. Brenchley) came on the staff, being the first lady worker at the Laboratory. In addition to special research work, Miss Brenchley took over also the whole control and supervision of the botanical work, grass separations, etc., Miss Grace Bassil coming in later as her assistant. Miss Brenchley also conducted very extensive experiments in water cultures on "Inorganic plant poisons," and these experiments are still being continued by her at the present time. Miss Lilian Underwood was the next lady worker in Mr. Hall's time, coming in as soil physicist, and then Miss Bates as Mr. Hall's private secretary.

THE JAMES MASON LABORATORY.

In 1906 Mr. J. F. Mason, M.P., built and equipped the Bacteriological Laboratory named the "James Mason Laboratory." The building contained, besides the main room, a sterilising room, and also a private room. Dr. Hutchinson was installed head of this laboratory, and here important work, with far-reaching results, was carried out by him. He was joined later, about 1910, by Mr. T. Goodey, both working in the investigation on the bacteria in the soil.

Mr. Hall took over the private room as his study, vacating the old library, this being now used as a reception room for visitors, as well as a room for study.

A number of lads, at various times, came in as assistants, but generally left as they grew a bit older. Three of these lads continued on, have grown up, and are with us to-day, viz., A. H. Bowden, W. Game, and F. Seabrook. Bowden came in 1909, first as lad assistant in the James Mason Laboratory, but was soon brought

into the Main Laboratory, and trained to do the determination of nitrates, etc., in soils. W. Game, as before stated, came in 1911 as my own assistant in the nitrogen work and the daily meteorological records, of which I had been in charge for all these years. F. Seabrook also came in 1911, as lad assistant in the Bacteriological Laboratory.

RESEARCH WORK AND WORKERS.

In 1907 Dr. Russell came to take up work at the Laboratory, as the Goldsmiths' Company soil chemist, coming from Wye Agricultural College. The inner side room, which had been used by Dr. Miller for photographic purposes, was cleared and fitted up as a small laboratory for Dr. Russell's use, and here much important work connected with soils was done by him. Many new problems now opened out, new investigations and necessary experiments had to be made, and it was to meet this demand that the Society for Extending the Rothamsted Experiments was formed. Grants were made from various companies and committees for special work, soil investigations, etc., a number of private gentlemen also giving generous financial assistance, and so the society was started, and under Mr. Hall the various problems were taken up and most minute investigations made.

During the years 1907-8-9 a very important and extensive set of experiments were conducted by Miss Brenchley on the development of wheat and barley grain. I remember that a great number of growing stems were selected, with the ears just coming into bloom, and as nearly as possible at the same stage of growth. These were tied up with red wool, so that they were easily distinguished among the other growing corn. Some were then cut every day or two from that time onward until the corn had fully ripened. These enormous numbers of samples, when brought to the Laboratory, were treated with minute care, each ear being dissected and the corn picked out, weighed, and the weights recorded, the necessary analysis being made in each case. People as they passed along the field used to wonder what the red marking was for, and they often said to me, "What on earth have you got those ears tied up with that red stuff for?"

In 1910 a survey of the soils of Kent, Surrey and Sussex was made, and I recollect what an enormous number of samples of soil were dealt with in connection with it. I did the nitrogen work, Oggelsby was taken from his work of grinding and preparing samples for analysis, and was trained by Mr. Hall to do the mechanical analysis in these soils; also the determinations of phosphates, potash, lime, carbon, etc., in them. It was for the purpose of work connected with these samples that a little hot-air engine with an accompanying shaker wheel was procured. This

apparatus was placed in the Kjeldahl room, on the stone bench under the east window. The engine was near the water tap and sink, so that the shaker was brought close to the east window which faced the road along the front of the Laboratory, the shaker being clearly seen from there. This revolving wheel attracted a great deal of attention from the passers by, most of whom used to stop to satisfy their curiosity. One evening two cottage women were passing along; one I knew very well, she was a native of the place, the other woman was a stranger. When they were opposite the window, they too stopped to look at the revolving wheel. "Whatever is it and whatever are they doing with it?" said the stranger. The native (I suppose not wishing to show ignorance of the place and knowing that there were gauges of which she had heard me speak) answered, "Well, I think they call it a frost-gauge, you see," said she, "that thing keeps going round like that all night, and then in the morning when they go to look at it, they can tell how cold it has been in the night." "Well, I never did," said the stranger, "what funny things they do do to be sure."

Another important work, entailing a vast amount of sampling of soil, herbage, etc., was undertaken in the experiments with the fattening and non-fattening pastures of Romney Marsh. Here again I did the nitrogen work, and also sometimes helped in the botanizing of the herbage, each species being kept separate and chemical analysis of each species made, samples of the growing herbage having been taken at definite periods. Oggelsby was trained by Mr. Hall to do the determinations of potash, phosphoric acid, etc., in the ash of these herbages. From this time, ash analysis when required, has been done here, none being now sent away, as formerly.

A long course of experiments (extending over several seasons) on the formation of sugar, etc., in the growing leaves of mangolds and other plants, were conducted by Mr. Campbell, and later by Messrs. Davis, Daish, and Sawyer. Samples of the growing leaves were freshly gathered at stated hours during the day and night from the various plots in Barnfield. I remember seeing the gleams of light flitting about as the lantern was carried from plot to plot on a dark night. Some people, a bit superstitious, and not knowing the cause, said that it was a will-o'-the-wisp about the field.

For the purpose of these experiments a new drying oven was obtained, and when it was fixed in its place, others in the Laboratory took advantage of it, and began to use it for their work. Mr. Campbell wrote upon the front of it the words, "Our oven" and his own initials, V.A.C., also those of A. Oggelsby "A.O.", and then "L.U."—the latter being Miss Underwood's initials. Under these were drawn a pair of spatchelors—crosswise. Then again was a drawing of a mangold-wurzel root with its spreading leaves.

Under this, again, were the letters M.O.B.C. I found out that these letters stood for the words, " My own blooming crest !! "

In the early years of Mr. Hall's directorship also a series of experiments, for two or three years, were carried on by Mr. Spencer Pickering on the growth of apple-trees grown in sand, in large glazed earthenware pots. Some were in sand, free from any surface vegetation ; others also in sand, with a thick growth of grass all over the surface. These pots were kept in the Laboratory ground, and Oggelsby, Willis, or I had the oversight of them, watering, weighing, noting, etc. Mr. Pickering also had a small fruit plantation on the north side of the Broadbalk Field. These trees were planted in trenched and untrenched soil, similar experiments being carried on at Woburn at the same time. Samples of the soil from the untrenched and trenched land being taken at frequent intervals, both here and at Woburn. The nitrates in all the samples were determined at the Laboratory here by Bowden. Woburn people came to attend to the pruning, etc., of the trees. One apple-tree at the Laboratory was grown in water in a large glass vessel ; this tree after a time became very sickly looking, and appeared almost dead. Mr. Hall told me to clear it out of the way, and said, " Stick it in your garden, it might, perhaps, recover." I did so, and to-day it is a very nice tree ; rather dwarf, but generally bears some fine fruit. The variety is Warner's King of the Pippin.

These are a few of the experiments, and a note of a little of the research work which was carried on during Mr. Hall's directorship. There were many others ; the results of all these investigations, or, at least, most of them, were, or have been, published from time to time in the various agricultural, chemical and other scientific journals.

ROYAL AGRICULTURAL SHOW EXHIBITS (PARK ROYAL), AS SENT BY MR. HALL.

I call to mind what a deal of interest was evinced at the first of the Royal Agricultural Society's Shows held at Park Royal, in the exhibit which was sent by Mr. Hall from the Rothamsted Experimental Station ; among which was staged loaves of bread, made from the flour obtained from the wheat grown on the various plots in Broadbalk wheat field. So much corn from selected plots was kept separate, despatched to Weybridge, Surrey, where it was ground into flour and loaves of bread made. They showed a very remarkable difference in the rising of the dough. These loaves (and others made from Canadian and other wheats which were shown) were in connection with the research work then being carried on at the Laboratory by Mr. Atkinson, upon the strengths

of various types and varieties of wheat grown in Great Britain, Canada, Russia and other countries.

In the following year also great interest was centred in the Rothamsted exhibit (also at Park Royal). Mr. Hall had for this exhibit square blocks of soil with the growing turf cut from the experimental grass plots. They were cut out and lifted bodily into specially prepared boxes, which had been painted green. They were despatched to the Exhibition by road, and arrived quite fresh, the herbage being then in flower. Two or three times they were watered during the Exhibition ; the foliage began to get a little yellow towards the end of the show, but otherwise stood up well, and, as I have said, attracted great attention.

MR. HALL BECOMES F.R.S.

When Mr. Hall was elected a Fellow of the Royal Society in 1909, a dinner was given in his honour and to celebrate the event. A number of persons connected with, or interested in, the Laboratory were present. Sir Charles Lawes-Wittewronge, Professor Armstrong, Professor Farmer, Mr. Spencer Pickering, F.R.S., and Mrs. Pickering, Mr. T. Wilson, Mrs. Warington, and all the members of the Laboratory staff and their wives.

The event took place in the Sample House ; carpets, rugs, curtains, pictures, chairs, lounges, lamps, etc., were lent for the occasion by members of the Laboratory and friends, and Miss Brenchley, with several ladies, set to work and soon made quite a transformation of the interior of the building. The large room was converted into a dining room, and the smaller into a drawing room. When the tables were laid for dinner they presented a very pretty sight with the ferns, flowers, and shaded lights.

Sir Charles came round with Miss Brenchley, who introduced the guests to him. Mr. Alfred Freeman, I, and several others, were sitting chatting together when Miss Brenchley and Sir Charles came up to us. Miss Brenchley began to introduce us, when Sir Charles said, "Why, I know all these, they are all old acquaintances."

ADDITIONS TO STAFF.

In January, 1910, Mr. W. Pearce came in as caretaker to fill the vacancy caused by the death of Mr. C. Bigg, and a bit later Mr. B. Weston also came on the staff. Pearce took over the duties of caretaker, which now included the oversight of the new greenhouses, etc. These duties gradually increasing as new investigations and new research work were undertaken. Weston took over the

ashing, dry matter work, and also the charge of crop samples from the experimental fields and research experiments, sampling same for analysis, preserving, etc.

AMERICA VISIT

In accordance with the provisions of the the Lawes Agricultural Trust, Sir Henry Gilbert, Professor Warington, and Dr. Bernard Dyer had at different periods visited America and delivered addresses and lectures at the various agricultural stations and colleges, on the work done and results obtained at the Rothamsted Experimental Station. In the early years of Mr. Hall's directorship he also paid a visit, the occasion being, I believe, when the members of the British Association met at Winnipeg, Canada. On his return he gave a very interesting lantern lecture in the Public Hall describing his tour.

CONVIVIALITY.

I often think with pleasure of the happy times of this period. Occasionally during the winter months an entertainment was given in the main room of the Sample House, the stage being erected at the far end.

In the programme of the first, I recollect, a little play was given, the title of which was "The Ring and the Rose." This entertainment was mostly carried out by Mr. Hall and members of his family and household. I remember also how capitally Master Christopher Hall performed his part in the play mentioned.

On another occasion a most enjoyable entertainment was given by the members of the staff, one of the items being a very amusing farce entitled, "The Mummy." Mr. Petherbridge made a capital professor, and Mr. Goodey also did well as the mummy, Miss Brenchley taking the part of the professor's daughter admirably. Miss Bates, Messrs. Davies, Hanley, and others also took their parts excellently. This was the first time I had heard Mr. Goodey sing. The song was announced, but he could nowhere be seen, when suddenly he popped up from the inside of a large sheet-iron cylinder which stood upon the stage, and he sang his song whilst standing in it, we could only see his head and shoulders. The cylinder was one of those later used by Miss Underwood in her soil investigation, and is now at the present time in use by Mr. Keen, being one of the set of cylinders in the allotments. On this occasion Mr. Hall read Dickens' short article on the Rothamsted Allotment Club, entitled, "The Poor Man and his Beer." The building was well filled at these entertainments, invitations being sent out by the staff inviting friends

CHRISTMASTIDES.

The Christmastides of this period were also very jolly times ; as the festive season drew near a cheerful and jovial spirit seemed to gradually creep over the place, and, by the time Christmas itself had arrived, a regular Dickens' spirit of Christmas pervaded. Presents were given and hearty greetings exchanged. These expressions of goodwill were not costly articles, but generally some little item to cause a bit of amusement and seasonable fun. Mr. Campbell and Dr. Hutchinson were the moving spirits in the mirth, and I have no doubt chose the various articles and concocted the humorous descriptive labels. The boys here at that time had each half-a-crown, wrapped up, and on the wrapper written the words, "For a good boy." These surprise tokens were generally awaiting us when we came back from the midday meal on Christmas Eve, being placed on our particular benches. One year they were distributed from a Christmas tree.

The first I had, I recollect, was a long parcel which, when I undid and opened the lid of the box, I found inside a very beautiful young lady doll, and on it was pinned a label with the words, Hello ! It's a different girl again," and then followed the season's greetings. At another time the surprise packet was a very compact and well-made toy pump, quite in working order, and it was labelled, "For use when flooded out at the rain gauges." At yet another time it was a toy boat, the label indicating that it was also for the same purpose.

I think the most amusing of all these humorous presents was one that W. Wilson one year received. On this particular occasion he found his part of the office table carefully littered with straw. In the centre stood a large and very handsome pig, made of sugar, and beautifully streaked about with red, also dotted about with a darker red. This was, I suppose, to indicate the lean parts of his body. Here and there on the straw were placed potatoes and other piggies' foods, so that it was altogether quite a brave show, and caused a good deal of laughter. Wilson himself seemed very proud of it (he was a great pig-keeper), and the label on the sugar pig, viz., "Fine Home-Fed Pork," he took as a compliment.

In like manner each received a little present, generally having reference to some humorous incident connected with their work. But the presents we most prized were those that Miss Brenchley gave us ; for several years she gave us each a painting, mostly of local views, which she herself had painted, and considering there were four or five of us, it must have taken her very considerable time and trouble. I have mine framed and hung at home in a place of honour. One is a painting of our Parish Church, and the other a seascape. I have given it a title of "A Stormy Sea at Sunset."

Time went on, and changes took place among the workers, some leaving and new ones coming in, so that naturally these pleasant customs gradually died out, but the memory of them are, and will be with me, a pleasure to dwell upon.

MISS BRENCHLEY BECOMES D.Sc.

In 1911 the degree of Doctor of Science was conferred upon Miss Brenchley. The news was received at the Laboratory with a spontaneous outburst of rejoicing. A procession was formed of the research workers and others, and, headed by Dr. Hutchinson and Mr. Goodey, they marched round the main rooms of the Laboratory, Mr. Goodey bearing a banner (made from a sheet of brown paper) having the word "Excelsior" chalked in large letters upon it. A humorous home-made diploma was also devised by several of the members, signed by them and presented to her. Dr. Brenchley had it framed, and it now hangs in the ladies' private sitting-room.

NEW WING.

Notwithstanding the additional accommodation provided by the new James Mason Laboratory, the place again began to get very congested, and the workers very cramped in their working and allotted spaces. Up to 1911 the Rothamsted Experimental Station had received no Government help, but in that year the Board of Agriculture decided to make an annual grant to the station, out of the Development Fund, and also a grant towards the building of the new wing.

STEWARDS, 1872-1922.

In the October of this year Mr. Eames came to us as Farm Manager, and this brings to my mind the many stewards or bailiffs with whom I have worked or been associated during my long term of service. The first steward I remember was named Hipwell, and next a man named Bird. These, respectively, resided at the Rothamsted Cottage. After Bird left, the cottage was let to a private family named Fells, and after them to Mr. Henshaw, the retired village schoolmaster (the stewards after Bird living in the cottage at the Farm). Following Bird came Shore, Wood, Pipkin (and for a time Col. Durnford supervised the estate and the bailiffs were under his authority). Next came Aylen, and next Osborne, then J. Sears, and lastly Mr. Eames, who took up his residence at the Rothamsted Cottage upon its becoming vacant at Mr. Henshaw's decease.

Following shortly upon this time and, I believe, shortly after the death of Sir Charles Lawes-Wittewronge, over two hundred acres of the Rothamsted Home Farm were taken over on a long lease by the Society for Extending the Rothamsted Experiments, being worked together with the experimental land, this forming a farm on its own.

MR. HALL'S RESIGNATION.

And now we come to the year 1912, the year when Mr. Hall resigned the directorship to become, at first, Development Commissioner, and afterwards Permanent Secretary to the Board of Agriculture. Whilst serving in this capacity, the honour of knighthood was conferred upon him; when we heard of the event we were all greatly rejoiced that this honour had been bestowed upon so worthy a citizen.

At the thought of Mr. Hall's intending departure we were very sorry, all regretting his resignation and departure from among us. Before leaving us, he and his family gave a farewell dinner in the Public Hall to which we all, together with our wives, were invited. The event seemed more like a large family party, everyone, whether of higher or lower social standing, mixing freely one with the other—everyone seeming perfectly at ease.

DR. E. J. RUSSELL'S APPOINTMENT AS DIRECTOR.

Soon after, we heard that Dr. Russell had been appointed his successor, and of this we were heartily glad, being well known to us, and having been working some years among us, it seemed quite a matter of course that it should be so, and thus we cordially welcomed and acknowledged his authority. He came more as a friend having authority than as a stranger; this welcome we have had no cause to regret.

Dr. Russell soon brought all his tremendous energy into the work, and many were the various and difficult problems tackled by him and his band of research workers, whilst I and others continued our work under his directions with the Classic Experiments, Mr. Eames supervising and also managing the now greatly extended farm area.

ADDITIONAL RESEARCH WORKERS.

During this year, or thereabouts, a number of fresh workers came among us: Messrs. G. C. Sawyer, W. Buddin, B.A., Keen, A. Appleyard, E. Horton, K. McLennon, Miss Helen Adams, and

others—Mr. Keen, shortly after his arrival, taking up the post of Soil Physicist for the Goldsmiths' Company. G. Lawrence also in this year came on the staff as general assistant, helping principally in the pot work.

NEW WING AND DYNAMO HOUSE.

The new wing now began to get nearer completion, and on June 27th, 1913, it was formally opened by the Rt. Hon. Walter Runciman, President of the Board of Agriculture. At this function a large and distinguished company gathered in the main room of the Sample House, to hear him declare the new wing open and to listen to his and the various addresses. In the evening a very successful conversazione was held, to which most of the prominent local residents were invited, Dr. and Mrs. Russell receiving the guests as they arrived.

This wing is now incorporated in the new building, so that I need not dwell upon the various rooms, nor the special uses to which they are put. They are now, as then, with the exception of the smaller front room, on the first floor. This was at first the Library, but after a time shelves were moved out, the volumes being deposited in the more commodious Library in the new building, and the room was then fitted up as a small laboratory for Dr. Miller, but is now used for statistical work and is known as the Statistical Laboratory.

OTHER RESEARCH WORKERS.

The dynamo and battery house, of which W. Pearce has charge, was built at the same time, the new building being supplied with electric current throughout, the same being used for many and various purposes. Needless to say, the director, research workers and others found these larger rooms and up-to-date fittings a great boon as they moved into them from the old congested building.

With, or shortly after, the opening of this new wing came other workers, Messrs. C. H. Martin, K. R. Lewin, E. H. Richards, W. Weir, Gregory, Sonnenfeld, also one or two more lady workers, Mr. Richards coming in as the Rupert Guinness Research Chemist. The various branches of work taken up were many and complicated, nor where they always confined to crops grown on the farm, nor to agricultural soils, but attention was also paid to greenhouse soils, tomatoes, chrysanthemums, etc. The chrysanthemums were for part of the time housed in the conservatories at Aldwickbury. They were grown in treated, untreated, and partially sterilised soils. All these investigations were carried out by Dr. Russell,

with Mr. Petherbridge as his assistant at first, and after him Mr. W. Buddin. These same problems, and the studying of the effects of various new sterilising or partially sterilising agents on the organisms in greenhouse soils, and on the tomato plants grown in these particularly treated soils, were until quite recently carried on by Mrs. D. J. Matthews, the W. B. Randall research biologist, the investigation being on a much larger scale.

NEW FARM BUILDINGS.

In 1913 the new farm buildings and adjoining cottages were ready for occupation. These farm buildings, which were designed by Mr. Eames, were, with their fittings, equipment and stocking, provided by grant from the Development Fund, by public subscriptions, private donations, etc. Thus at the completion and occupation of the new farm was severed for me the connection with the old home farm, with all its old rambling sheds, barns, buildings, and spacious yards, wherein had been gathered year by year the harvest and products of the experimental crops to await the yearly thrashing, weighing and recording of results. Also was severed all the old associations connected with it—the harvest homes, largees, and all the old-time customs.

ROYAL SHOW EXHIBITS, BRISTOL, ETC. (AS SENT BY DR. RUSSELL).

I have mentioned that the exhibits arranged by Mr. Hall for the Royal Show at Park Royal attracted great attention, so also did that arranged by Dr. Russell for the Royal Show held at Bristol in 1912 attract, if anything, more attention. For this exhibit Dr. Russell caused to be made a number of model ricks, some of hay and some of wheat straw, showing in proportion the produce from the unmanured plots, and plots receiving the various manures in the experimental grass plots, and the permanent wheat plots in Broadbalk Field. Also among the exhibits were very fine growing plants of tomatoes (bearing large clusters of fruit) growing in steamed soils, and others, for comparison, growing in unsteamed soils. Beside these were also pots of growing corn, illustrating the experiments on liming then being carried out by Dr. Hutchinson and Mr. McLennan. Pearce and I went to Bristol with the exhibits, for which a special coach was provided by the Midland Railway Company, we travelling in the same coach, the pots containing the tomatoes and other plants being placed on the floor of the van. We had to keep a watchful eye on these pots, for at every lurch of the carriage the plants swayed considerably. We jumped

up and steadied them as well as we could, but at each of these swaying periods we quite expected to see some of the fruit clusters break off ; but, however, only one of the smaller bunches got damaged. Arriving at Birmingham, we were shunted into a siding, and there we had to wait until about three in the afternoon, until a special train with exhibits from the north arrived ; when it did arrive we were connected on to it, and so started off again, arriving at Bristol somewhat late in the evening. We were taken into the siding, specially arranged for the occasion, and had to begin to unload at once, as the train had to be moved out of the way. So we unloaded our van, placing the pots on the ground by the side of the gangway until we could get the conveyance to take them to the show grounds.

Now the other coaches in this special train contained mostly horses and cattle which, as they were derailed, had to pass along this same gangway. Having been so long shut up in the coaches, they pricked up their ears when they saw our nice green growing plants, and every now and then tried a grab at them. We had no room to move the pots out of their reach, and so all we could do was to spread out our arms like wings and jump up and down in front of our plants until all the cattle had passed along the gangway. They only succeeded in taking off the ends of the corn plants growing in one pot.

At last we got to the show ground and to the Educational Department. It was now getting late. We found the exhibits of nearly all the other agricultural stations arranged and in order. The bay allotted to us had to be draped with the special canvas we brought with us, the erected stands enlarged, and all the exhibits placed and ready by 10 a.m. next morning. Everyone was supposed to clear out of the building by 9 or 10 p.m. that night. We knew we could not get our exhibit ready if we had to clear out at that time, and so we persuaded the attendant to let us stay inside. I went into the town and brought some candles back with me, and so when the time came for clearing, the entrance was closed, and we were fastened inside the place. We lit our candles and again set to work until near midnight ; we then lay down on the benches for an hour or so rest, and at peep of day began work again, so that by about 9 a.m. we had finished the staging, labelling, etc., everything being in order for the opening. The late Mr. H. Frear, of the Woburn station, whose exhibit was in the bay opposite ours, was much concerned the night we arrived, thinking we should not be finished in time. He was agreeably surprised on coming in next morning, to find everything completed, but we never told him we had been working nearly all night. We went off to breakfast, and on returning found our bay nearly full of visitors, all of whom seemed to be evincing great interest in the exhibits shown.

SIR H. GILBERT'S LIBRARY.

During the year 1913 the volumes comprising the library of the late Sir Henry Gilbert, the former Director, were presented to the Rothamsted Station by Lady Gilbert, and as I saw the generally familiar books unpacked, many memories of Sir Henry and of the old times were recalled.

DEMOLITION OF OLD LABORATORY, ERECTION OF THE NEW.

Notwithstanding these new and welcome buildings, the station soon began to again get very crowded. As one problem was investigated, other problems opened out, and these required other workers to deal with them, and so on. And then, again, during later years, beside the regular staff, holders of scholarships and students from other institutions spent a certain amount of their time here, to study methods and ways of working and carrying on their investigations, analytical work, etc.

Besides all this, the old laboratory began to get very unsafe, and it was feared that if left standing, some day in the near future the building would collapse about our ears. After much deliberations among those responsible and in authority, and other influential persons interested, it was decided to take the building down. Seeing that the centenary of the birth of Sir John Lawes would take place in 1914, and that of Sir Henry Gilbert in 1917, it was resolved that an effort should be made to celebrate the centenary of the founders of Rothamsted Experiments by the erection of a new and commodious laboratory. Towards this object a grant was promised from the Development Fund, provided a like sum was raised by subscriptions. This was done, and sufficient funds being assured, the old building was taken down in 1914, and the new commemoration laboratory begun. The many thousands of bottles containing the ash samples, etc., from off the shelves of the old laboratory were placed in specially prepared boxes and housed in the Sample House.

It seemed strange to see the old place disappearing as the workmen cleared away bit by bit. Having been associated with it nearly all my life, I naturally missed the old building, its old familiar rooms and all its old associations, linking up boyhood, youth and manhood with the progress of later years. But yet the severance of old ties was not so keenly felt as I had anticipated, probably because the interior of the building had been altered and transformed from time to time, a number of old familiar objects having already been cleared away, and again, I now saw it disappear gradually as the pulling down process proceeded.

As the building was demolished, I watched with great interest for the laying bare of the old Foundation Stone which had been

laid, with fitting ceremony, at the south-east corner at the time of erection. As grass-picking boys, we had been told fabulous tales of gold coins and other things that had been placed in a casket or box, the said casket being inserted in a cavity of the corner-stone and sealed, so the story went. At length the stone was laid bare, at the same time all the fairy tales of casket and gold, etc., vanished. Coins there certainly were, and other things there certainly were. The beautiful casket we had been led to believe in, turned out to be an ordinary glass bottle of a bluish tinge, and the gold coins proved in reality to be only silver and copper. So far as I can remember, there were two silver coins ; the other coins, I believe, were a penny, a halfpenny, and a farthing. There were also parchments, but, unfortunately, the bottle had been very indifferently sealed, the damp had entered, and a good deal of the parchment was decayed, and the writing on other parts almost obliterated, whilst the copper coins had become very cankered.

During the period of the demolition of the old, and the erection of the new laboratory, it is easy to perceive that we were all greatly put to for working room. On looking back it seems almost a mystery how we all managed, but, however, Dr. Russell surmounted all difficulties. He had every conceivable place that could be of service for a time utilised for work. The Sample House was made much of, a part being partitioned off and used by him as his private room and study, all the outbuildings, as far as possible, being brought into use ; and so the work continued without a break.

THE GREAT WAR. (THE SUPREME SACRIFICE MADE AND HONOURS WON.)

And now we come to the period of the great and awful war—a war in which practically the whole civilised nations of the world became more or less involved. This station, in common with every other place throughout the kingdom, suffered from the depletion of its staff. Several members at once answered their country's call ; others, again, later, as soon as circumstances allowed, and others, again, as soon as they became of the required age. Others there were who for physical reasons were not accepted ; others, again, stayed on, and did very important work in the service of the various Government Departments called into being to deal with war problems.

The first to be mobilised were A. J. Daish, C. H. Martin, and G. Lawrence. These at the declaration of war were at their respective camps, and were mobilised straight away. Next to follow was A. Bowden, then K. R. Lewin, B. A. Keen, W. Weir, A. Clayton, W. Buddin, V. A. Campbell, K. McLennan, G. C. Sawyer, S. J. K. Eames, C. Pearce (W. Game and F. Seabrook joining up as they came of the required age). Miss Bates and Miss

Bassil also volunteered for service, and were accepted, Miss Bates as the Matron's Private Secretary in one of the Cambridge War Hospitals, Miss Bassil going over to France, joining the W.A.A.C. for secretarial work.

Two of those who joined made the supreme sacrifice, viz., Lieut. C. H. Martin and Lieut. K. R. Lewin, both young men of great promise, and of courteous and charming manners. At the mention of their names I pause and bow my head in honour to their memory. (They rest in peace.) The former was killed in May, 1915, the latter March, 1916.

Several of the others were more or less severely wounded, some two or even three times, whilst others were laid low by disease. Happily these have all recovered, some completely, others not so completely, but sufficiently to be able to return and take up their work again. Honours have also been won on the field by Capt. McLennan, who was decorated with the Military Cross, and Lieut. Weir, with the Military Cross and Bar, whilst Cpl. G. Lawrence has received the Military Medal and 1914 Star.

Others there were who remained at the station, and their services and peculiar knowledge required for particular purposes were used in the interest of the Board of Agriculture, and later also for the Ministry of Munitions and for the Food Production Department. Several young ladies also came in to take the places of the workers who had joined His Majesty's Forces (Miss Glynne, Miss Jackson, etc.), and these also did their share in the work now involved.

I venture to assert that the various Government War Departments and Committees received most valuable help through the results obtained and advice given by Dr. Russell and his band of workers.

During all this anxious war period most of the research work was continued, the old experiments and field work, and also the numerous new experiments required were kept going, though with greatly depleted staff. At the joining up of Mr. Eames, Mrs. Eames came forward, and bravely shouldered the responsible position of her husband as farm manager and book-keeper. S. Currant (the farm foreman), B. Weston, and I, each in our respective spheres, did all we could to assist her, and so she carried on the difficult duty until her husband's safe return.

In recognition of his services, the honour of the O.B.E. was conferred upon Dr. Russell. At this we were all very glad, because no one knew better than ourselves of the amount of work and anxious thought he had spent upon the difficult war problems undertaken.

At the departure of Miss Bates for Cambridge, Miss Johnson came in as Acting Private Secretary, whilst Miss Norah Pearce temporarily filled the place of Miss Bassil as Assistant to Dr. Brenchley.

MR. A. FREEMAN, 1875-1915.

In May, 1915, the station sustained a great loss in the death of Mr. Alfred Freeman. As before stated, he succeeded his father, the late Mr. Frank Freeman, as what was called "The Farm Experimental Man." Having assisted his father for many years in the working of the Permanent Experimental Plots, he knew their history and treatment by heart, and was very zealous and conscientious in all his work connected with them. He had received a good, sound education at the British School in the village, under the late Mr. Henshaw, schoolmaster, and was far above the ordinary type of farm labourer in intelligence, being a great reader and good speaker. He could converse upon almost any subject, political, religious, or otherwise, but his pet subject was Natural History. In common with most workers on the land, especially the older men, the habits of birds and the lower wild animals were keenly observed. I listened with deep interest to a description given me of a terrific fight to the death between a rat and a weazel. The encounter took place at the lower end of Broadbalk Field, I believe. Again and again they closed with each other, separating, only to close with each other again the next moment. So absorbed were they in their deadly conflict, they took no notice of the men watching them. Finally the weazel proved the victor. Freeman said that a rat, however large, has no chance against the little wiry weazel when once in earnest. Other similar stories of wild life which he had observed whilst on field work he has related to me. Unfortunately, unlike his father, he had no assistant in training to follow after him on the field work, so that at his death a blank was caused which up to the present has not been satisfactorily filled.

He had been a faithful and active member of the Primitive Methodist Church nearly all his life. The first part of the funeral service was held there. In the churchyard of the Parish Church his body was laid to rest. Large numbers of the Primitive Methodist congregation, choir, and Sunday school, together with a number of the laboratory staff and other parishioners, attended the committal service to show their last token of respect. And so within a very few years seven of the old and original staff passed to their rest :—F. Freeman, J. Willis, A. Freeman, W. Wilson, C. Bigg, G. T. Dunkley, Dr. Miller. As I pause at their peaceful resting-places, I seem to hear the Biblical words which could be applied fittingly to each one of them : " Well done, thou good and faithful servant."

During the latter part of W. Wilson's illness, Miss Gimingham (now Mrs. Rymer Roberts) came to assist in the secretarial work, and at Mr. G. Dunkley's death took over the secretaryship. I think it astonishing how quickly she gathered up the broken threads, or, at least, most of them, which had then so suddenly

been snapped asunder. Oggelsby and I did all we could to help her in her task of gathering up, in locating the many and various records, and in other ways.

OFFICIAL OPENING OF THE NEW BUILDING.

Time passed on, the weary and terribly anxious war years dragged slowly by ; in the meantime the new building was erected. As soon as possible the rooms as they were finished were occupied, most of the cupboards, benches, etc., from the old Laboratory were, as far as possible, renovated and utilised in the fittings of the new.

The chief glory of this handsome building is, in my opinion, its magnificent library, already much frequented, for the purpose of study, by research workers, students and agricultural teachers, both of our own and other countries. Nor need I dwell upon the new branches of work recently undertaken, Plant Pathology, Entomology, Mycology, etc., etc., beside the experiments of the Electro Culture Committee now being conducted with both pot growth, and the larger experiments in the fields. Suffice to say, that as soon as it could be conveniently done, after peace was declared, the new building was with fitting ceremony formally opened by Sir Arthur Boscawen, in the unavoidable absence of Lord Lee of Fareham, on the 20th day of October, 1919.

This brings me to the end of my, I am afraid, very rambling and disjointed reminiscences concerning the Laboratory itself, but it has been suggested that it would be of much interest and an appropriate addition to this narrative if I gave a short account or sketch of the Permanent Experimental Fields, of their working, etc., from my early acquaintance with them onwards, together with various anecdotes and old customs connected therewith. In response, therefore, to this suggestion, I will endeavour to deal with the subject in Part IV.

PART IV.

REMINISCENCES OF EXPERIMENTAL FIELDS, ETC.

QUAINT OLD AND ALSO MODERN METHODS OF WORKING.
NUMEROUS AMUSING TALES AND HUMOROUS ANECDOTES.

HARPENDEN:

ITS GRADUAL CHANGE FROM AN AGRICULTURAL VILLAGE
TO A MODERN RESIDENTIAL CENTRE; AND ITS BEARING
ON FARM LABOUR.

VARIOUS EXPERIMENTS, VARIOUS FIELDS.

WHEAT VARIETIES.

BIRDSCARERS.

EXPERIMENTAL FIELDS: DESCRIPTIVE NOTES.

AGDELL.

BARNFIELD: RAIN AND DRAIN GAUGES, ETC. ROOT EXPERIMENTS.

GEESCROFT.

THE GRASS PLOTS.

HOOSFIELD: BARLEY PLOTS, LEGUMINOUS PLOTS, ALTERNATE
WHEAT AND FALLOW PLOTS, POTATO PLOTS.

LITTLE HOOSFIELD.

VARIOUS EXPERIMENTS: ELECTRO CULTURE, DEMONSTRATION
AND TRIAL PLOTS (WAR PERIOD).

THE GARDEN CLOVER PLOT.

THE BROADBALK FIELD:

DESCRIPTIVE NOTES AND TALES. PREPARING, PLOUGH-
ING, SEEDING, LABELLING, HOEING AND WEEDING,
CUTTING AND CARTING, GLEANING, HARVEST HOMES,
THE WILDERNESS, BOMBING, THRESHING, DUMPLING
DAYS, ETC.

THE ROTHAMSTED ALLOTMENT CLUB
IN ITS CONNECTION WITH THE LABORATORY.



ROTHAMSTED EXPERIMENTAL STATION.

PART IV.

REMINISCENCES OF EXPERIMENTAL FIELDS, ETC.

QUAINT OLD AND ALSO MODERN METHODS OF WORKING.
NUMEROUS AMUSING TALES AND HUMOROUS ANECDOTES.

HARPENDEN: ITS GRADUAL CHANGE FROM AN AGRICULTURAL VILLAGE TO A MODERN RESIDENTIAL CENTRE; AND ITS BEARING ON FARM LABOUR.

In order that you may better understand the conditions under which the work of early years was done, and also because it has a certain bearing on what I am about to relate, I would like to take you back to the Harpenden (more commonly called Arden) of my very early boyhood. The village then had an almost entirely agricultural population, nearly all the men being employed on the land, a few at the one hat factory, and also a few at the two breweries, these being the only industries in the village, besides that of straw plaiting, in which home industry many of the women were engaged. Other women worked on the land at certain seasons; many of the boys also, as soon as they were of an age that they could possibly earn anything, went to work on the land. The parents were not then troubled with School Board Officers. Of course, the majority of the cottagers had some little ambition for their children's welfare, and managed, somehow or other, to send them to school, at least for some years, but it was a struggle in those days for the agricultural labourer to find the pence for school fees, money for books, etc., especially if there was a large family. Schooling had to be paid for in the old days, although the fee was small. I am referring to the British Schools, to which I myself went.

At this time straw plaiting was rapidly declining, so that even more women turned to land work when available. Consequently, there was always plenty of labour, both of men and women, and also of boys to be obtained. Besides this, again, there had always been plenty of Irish labour available, both Irish men and Irish

women coming over to England in large numbers at the harvest season, and so it must have been for long years past. In one of the old Rothamsted Note Books there is a note to the effect that on August 14th, 1852, 35 Englishmen and 30 Irishmen were reaping, binding and shocking wheat in Broadbalk Field.

The land all round about the village was arable. Where are now roads, avenues and villas, was then land comprising Top Street Farm, Church Farm, etc. My people have told me that with the advent of the Midland main line through the village things began gradually to change. After a few years most of the surrounding land changed hands, was sold, and opened up for building purposes. The village gradually changed from purely agricultural to a modern residential centre, and with the changing of the place, so also the character of the population gradually changed, those taking up land work for a livelihood getting fewer and fewer. Many of the boys stayed on longer at school and became better educated. Of these, on leaving school, many went to London, Luton or St. Albans as clerks, or in the hat trade, and a fair number I remember going on the Midland line as clerks and porters—very few turning to farm work. Many young men at this time who were on the farms, left and went to work as jobbing gardeners, etc., at the many new residences rapidly springing up, whilst many of the women also went out as charwomen, washer women, etc., and the greater number of girls going into the hat warehouses at Luton or St. Albans, so that to-day very few *bona-fide* labourers are to be found on the land. It is a greater part casual labour that can be obtained, and of the women, a real *bona-fide* land-worker is a still greater rarity.

In my early years at the Laboratory the men on the Rothamsted Farm had, most of them, been working there for many years. They were quite accustomed to the Experimental Plots and all work connected with them, and needed not so much the watchful eye, as is the case nowadays, when the workers, or, at least, many of them, are constantly changing.

At this time the Rothamsted Park comprised but a comparatively small area. There was a roadway from it leading into what is called the Coach Lane. This road ran along by the oak trees on the right of the present carriage drive. The chief entrance to the Park at this time was at Hatching Green. The carriage way to the village that is now, was made, and the lime trees on either side planted somewhat over 40 years ago. All the land as you pass from the Laboratory to Rothamsted; in front, as far as the old Park, and to the left as far as the Redbourne Lane, and again to the right, away across to the now St. Nicholas Estate, was then arable land. It was mostly laid down to pasture at the time of the great strike of agricultural labourers under the late Mr. Joseph Arch. The little spinneys dotted about the grass land being planted by Sir John some few years later.

VARIOUS EXPERIMENTS—VARIOUS FIELDS.

Experiments were carried out in a number of fields from time to time, beside those in the Permanent Experimental Fields. Most of these fields, however, have been thrown into grass land : High Field, Park Field, Ten-Acre Field, Nancy Commons, the Bull Fields, etc. ; whilst Claycoats, where beans and oats were grown, was planted with firs, and is now emerged into the preserves. Sludge experiments were also tried, I recollect, in Apple-tree Field. This is now the little grass meadow between the two woods on the left, coming from the Grass Plots to Broadbalk, and on the other side of the young fir trees, planted by Sir Charles Lawes-Wittewronge as a back-ground for his sculptured group on the west lawn of the house.

Two of the fields have quite changed names even in my time. For instance, Stackyard or Rickyard Field was always called Sheepcote Field ; the name was changed when Colonel Durnford was overseer, the farm cornstacks for a few years being built at the south side of this field. And again, the field now called New Zealand Field got its new name, soon after the area now comprising the Kitchen Garden was enclosed, to make an additional Kitchen Garden for the house. The gardeners, on account of its long way from the home garden, gave the enclosure the name of New Zealand, and this name soon got fixed to the field itself. It is really a part of what was called Thirty Acres Field, the belt of fir trees skirting the east side being planted in comparatively recent years.

THE VARIETY (WHEAT) EXPERIMENTS.

For many years different descriptions of wheat were grown each year in a different field. There were sometimes over twenty different varieties of wheat. Frank used to call these plots "The Marities," a title which greatly amused Mr. Louis.

BIRD SCARERS.

Sir John liked to see the rooks, jackdaws and owls about the place, especially round the Rothamsted House. Close to the house, in the elm tree avenue in front, and also in the trees by the side of the garden, used to be quite strong rookeries, but some few years before his death the birds were driven off, and now they build farther away. This was done because a number of trees in the plantations died off, and it was thought to be due to the large number of rooks nesting there.

I recollect the boxes and other contrivances Sir John caused to be fixed to the trunk of the trees near the house and grass plots.

They were placed high up at junction of arm and trunk, being put there to encourage the jackdaws and owls to build in them ; but they were not a success. I believe all these now have fallen and disappeared. Both Sir John and Lady Lawes loved to see the hedges round the fields growing wild and rambling, having them trimmed as little as possible. The consequence was, of course, that a large number of sparrows and other small wild birds found harbour there. So that both at corn sowing and harvest time a number of bird-scarers (or crow starvers as they were called) were employed. Sometimes as many as six boys were engaged at different parts of the farm. On one occasion a boy named Ansell was so employed. Sir John, on going round the fields, found Ansell and another boy up the nut stems, nutting. "What are you doing there ?" said he. "Please, sir, I ain't a doing nothing," said Ansell. "What's the other boy do here ?" asked Sir John. "Please, sir, he's a helping me, sir," answered Ansell.

An old man, rather a noted character in the village, named Tom Plump, used to be bird-scaring in the fields of the Church Farm, adjoining those of Rothamsted. Tom used to shout at the top of his voice, so that one could hear him shouting and holloaing when far away. Sir John, when round the fields, must have heard him many times. When the rooks were very troublesome, Tom sometimes used to rave out—"Go back to Rothamsted and let Jack Lawes feed yer, we don't want yer 'ere." "Go back to Rothamsted, you old black devils, and let Jack Lawes look arter yer." I remember a gun-arrangement being placed in Broadbalk field. This gun fired off automatically, I think, every ten minutes or so, I am not quite sure ; but the birds soon got accustomed to it, and after a time took but very little notice of it. Frank used to say it was no good firing off at sparrows, excepting some were killed. If a few get killed now and again, the others get frightened and are off, otherwise they only fly from one side of the field to the other, and so on. This gun was introduced by Dr. J. Voelcker, and, I understood, they had a similar or similar ones at Woburn.

THE EXPERIMENTAL FIELDS.

AGDELL. And now as to the various Experimental Fields. First, Agdell, the Rotation Experimental Field. In the old map, 1623, I notice it is spelt Egdell, I have also seen it spelt Agdale ; Sir John himself spelt it Hagdell (when I have seen it so spelt I always thought of witches). We now always spell it Agdell. Originally there were 24 plots, then they were grouped into 12, and now grouped into 6 only. The first crop of the four-course rotation is Swedes. There used to be the "Fed on" Plots and "Carted off" plots. The roots grown on the "Fed on" plots were, in the earlier days of the experiment, eaten by sheep, which

were penned on the plots. When I first knew the field, sheep-feeding had been discontinued and, instead, those roots which had grown on the "Fed on" plots were pulped or chopped up in the field and spread over the soil of the plot, so that when this pulping was finished the field looked like a huge draft board. Those plots with the roots pulped and spread showed up white, whilst the "Carted off" plots showed the brown soil.

The permanently unmanured plots always produce a root very small, both in bulb and leaf, going back almost to a wild state. One year, I remember, they were exceptionally small; several casuals were working at the pulling and clearing this year. When we came to these plots, I said I would weigh these small roots on my scale in the field, instead of sending them to the weighbridge at the farm, as I had done the large roots from the other plots. I noticed two of these men brought their leaves to weigh, but did not bring any roots. I asked for the roots from the rows on which they had been working, and they said there were none. "There must be some roots," I said, "because I have weighed the leaves." However, they persisted there were none. I found out that being so very small and troublesome to clean, they had thought to deceive me, and had put the whole of the plants in their leaf basket, with some loose broken leaves at top, so that the whole contents of the basket appeared like leaf. However, I made them go through the whole heap on which they had emptied their basket and pick out all uncut plants. They did it, but kept grumbling and grousing. At last one of them said, "Well, if I had a farm, and couldn't grow no better swades (swedes) na' them there, I'd chuck up farming the reckly."

BARNFIELD : THE RAIN, DRAIN GAUGES AND METEOROLOGICAL INSTRUMENTS.

On our way we pass the Rain and Drain Gauges, with the various other meteorological instruments. With these gauges I have been familiar from my early years at the Laboratory. For a time I accompanied King at his daily recording, and soon took the records on my own. At this period there were two large gauges of $\frac{1}{1000}$ acre area called the "old" and the "new" large, also the small 5-inch funnel. The 8-inch gauge was added in 1881. The old large stood some little distance to the north of the present gauge (the new large); one can still see the depression in the grass land where it used to stand. This gauge had no brickwork about it at all, so far as I recollect. It was like a large squarish-shaped leaden funnel, fixed to four wooden posts which were let into the ground. The earth below the funnel had been taken out, so that one could get underneath, and here were placed carboys,

in which the water collected by the gauge was deposited. These carboys stood on an earthen bank or platform, each carboy being placed on a kind of low wooden trolley, with small wooden wheels, so as to be moved about more easily. The carboys were brought down to the Laboratory twice a day, if necessary, morning and night, and the contents weighed in lbs. The sides and front of this under-space had straw-covered hurdles placed around, to protect the carboys from the weather, but graduated tubes and cylinders had been introduced some little time before my acquaintance with the gauges, although the carboys and trolleys were still knocking about there. During the continuous heavy rains in November, 1876, the old gauge was flooded, the cylinders overturned, and the tubes all broken. It was then given up. During all the years, I do not remember having once missed the daily records. If unable to go myself, I have always made sure someone from the Laboratory would take the readings. These records have been taken in all sorts and conditions of weather. I have attended to them during storms and at nearly all hours of the day and night. Twice, I think, the large gauge has been flooded, so that the records from the small gauge has had to be adopted. On one occasion when cleaning the glass tubes I used a long pliable twig. On the end I tied a small piece of soft sponge, wetted it, and then pushed the twig up, down, and round inside the tubes. When I had finished I was very proud of them, they looked so beautifully clean. Next morning, on opening the door, I found nearly the whole of the tubes broken and lying on the floor in pieces, both of the rain and drain gauges. I was in a terrible way about it, but, however, Sir Henry was very considerate : he knew it was not done purposely, but he said it was an expensive lesson. It was supposed that a minute piece of sand was adhering to the sponge, and as I twisted the twig and sponge up, down and around the tubes, the sand acted as a sort of diamond and scratched the glass, the temperature cooled at night, the glasses all breaking. We fixed plain tubes in and got new graduates tubes as soon as possible ; since then I have never used a sponge to clean the glasses.

I remember a tremendous storm on the night before the August Bank Holiday, 1879. It was a terrific downpour, though lasting but a short time, the fall, I believe, being from three to four inches. Here again the large gauge was flooded, the record of the other gauges had to be adopted. It was the only occasion I have known when the houses in the village were flooded. Those houses lying anywhere low the water greatly damaged. The river Harp (I mean the little gutter running through the village) was swollen to a tremendous size, and the Gravel Pits were completely filled with water, the over-flow rushing through the Bowling Alley and flooding the houses. A man named Healy, I was told, swam from the village to the Bowling Alley. Maybe that was so, but he certainly swam the full length of the Gravel Pits. Sometimes, too, it has been snow

drifts to contend with. I remember one Christmas time, I think in 1886, whilst the others were making holiday on the Boxing Day, I had a merry time clearing away the snow drift which had completely blocked the doorway and almost smothered up the large gauge.

I have also been there at the time of terrific storms. Once, I think, in June, 1888, whilst attending to the 8-inch gauge, a sudden and very vivid flash of lightning quite dazzled me, and I made a note in my hand-book to say that when emptying the water from the small gauge into the measuring glass, the lightning dazed me and, unfortunately, some of the water was spilt. The record here, I recollect, was over three inches. There is another note in the same month also, to say that as soon as light, 3.30 a.m., I went to examine the gauges after a terrific storm, found all the cylinders full of water, and also some in attached carboy. Drew off so much from each cylinder in case of more rain before 9 a.m. The present collection of meteorological instruments now in use were obtained and set up in their present position by Sir Daniel Hall. Before these were acquired we used the records of Mr. Wilson's private instruments, the thermometer screen being in the grounds of River's Lodge and the barometer in the hall.

Nowadays almost everybody has a daily paper, in most of which the weather forecast for the day is given, but in my early days a daily paper was never thought of, except among business men and well-to-do people. When weather forecasts were first issued, Sir John made arrangements with the Meteorological Office to telegraph to Rothamsted the forecast each day during the hay and harvest seasons. A copy of the forecast he also arranged to be placed in the Post Office window, so that anyone wishing to see it could do so.

With regard to the sun recorder, I forget the year when it was introduced—I believe in 1891—but the first one used belonged to Mr. T. Wilson. After a time this was purchased by the Laboratory authorities, and the records have been taken and tabulated each day since. This ball was stolen on the night of August 15th, 1894, together with two sun maximum thermometers, and although a reward was advertised the ball was never found. One of the thermometers was recovered in a peculiar manner many months afterwards. A man walking up the common one day noticed a glittering object sticking out of a furze bush. He went to investigate, and found it to be a sun maximum thermometer ; the sun shining on it caused the glitter which attracted his attention. It proved to be one of our missing sun max. It was in no way damaged. The second ball was stolen on December 22nd, 1919. It was recovered, but all smashed to pieces ; mischievous boys had taken it, played about with it until tired, and had then smashed it up. They were found out and severely fined, receiving a strong caution from the judge.

One Sunday morning, many years ago, in the summer-time, I was on my way to the gauges. As I was passing the Allotment Club House, an old man named Ivory, who lived in one of the thatched cottages just above, was seated under the verandah of the Club House. Although only nine o'clock, he was dressed in his Sunday clothes, ready to attend the eleven o'clock service at the Parish Church. His large Prayer Book was lying on the seat by his side. When opposite to him, he called out to me, "I say, young man, you'll never go to 'eaven." I said I hoped I should. "Why," he said, "you can't expect to go, a running about on a Sunday mornin' arter them water things, when you've no call to." I didn't stop to argue with him, but passed on my way.

On one occasion my weather records led me to the Law Courts. It was the first time I had ever been in a witness-box, and it was in this way. A certain local gentleman had a wall built around his garden. He had it built in the winter, I believe, in December month, and local builders built it. Now it so happened that December of this particular year proved wet, and also severe night frosts, much rain during the day and severe frosts at night. The consequence was the outer mortar probably became frozen, perished and crumbly, although the builders stated they had taken all precautions against weather as far as they could. When the accounts were sent in, I understood, the gentleman refused to settle, stating bad material used, etc. The builders, on the other hand, said the material was good, but the fault was due to the weather conditions prevailing at the time he had the wall built ; Hence the Law Courts. Now, the builders knew that I took the meteorological records daily, and so I was subpoenaed to give evidence on that point. I thought it best not to trust to memory, but to take my daily record books with me. At length I was placed in the witness-box. The judge asked me if I recorded the temperatures daily ? Did I do it as a hobby ? Or was it my duty ? I told him it was my first duty each day. He then asked me to give him the minimum temperatures and the rainfall for the period in question. I took my books from my pocket and read each day's figures slowly and distinctly, until his lordship said that was sufficient. I noticed there was much noting of figures as I proceeded, and I had to hand my books to his lordship to look at. However, at length I came in for cross-examination, and I thought to myself, now I'm in for it. The lawyer or solicitor for the other side jumped up and his clerks handed him his papers ; he shook his robes, settled his wig, and looked me full in the face. I returned his look, and after a second or two he said, "So I suppose you are the nearest approach to the clerk of the weather that we are ever likely to see ?" I answered, "I don't pretend to say what will be, I only tell you what has been." At this point he seemed to cool a little, but he said, "Do you read the *Times* ?" I said "No, I read the *Daily Mail* sometimes." At this there was a little

laughter. "I suppose you would be greatly surprised," said he, "to know that the weather in London was fairly good at the time you want to make out it was so bad?" or something like that. I replied, "It was Harpenden we were talking about." "Then it would not surprise you," he said, "to know that the weather in London was comparatively warm for that time of year? I can give you the figures if you like" (or some words to that effect). I answered him that it was generally warm there. At this there was also laughter. I think the public took my answer different from what I really meant. The lawyer sat down and asked me no more questions. There were many other witnesses examined, both for and against. The final verdict being in favour of the builders.

BARNFIELD ROOT EXPERIMENTS.

On my first acquaintance with this field, sugar beet was being grown, the plots were then as now, save that Plot 3 is discontinued. The seed was dibbed in on the flat. In 1898 two new sets of sugar beet experiments were started, one set on what is called the valley, and the other on the three-cornered Plot 9, or the Doctor's Plot, as it was called at that time. These continued for about three years. In 1876 the first mangold crop was grown, and mangolds, with one or two exceptions, have been grown every year since.

The mangold seed was sown on bouts, being dibbed; each man had a wooden four-fold dibber, he walked sideways alongside the bouts, and pressing the dibber on the surface of the bout with his foot, made four holes of the required depth each time. Following the men came boys with the seed, carried in all sorts of old tins or cans. If they found it more convenient they would use their hats to carry the seeds, a few being put into each hole. Some seasons they were covered in with earth by means of short-branched twigs which the boys carried. Afterwards the bouts were lightly rolled. Sugar beet grows deeper in the ground than the mangold-wurzel, and for the purpose of lifting the beet crop a sort of wide two-tined fork was used, with an attachment for foot pressure. The mangolds are pulled by hand, the leaves cut off, and as much of the adhering soil as possible removed from the root with long-bladed knives or other implements. In early days, as the roots were pulled and cleaned, they were placed in large heaps on their respective plots, the leaves being weighed in the field as now. When all lifting was finished the roots were counted as they were being loaded up for the weighbridge. Now they are counted in the rows before lifting.

In some seasons I have had as many as thirty-four, or thirty-six, men working at this mangold job; most of the regular hands on the farm work at it, the others being casuals. Now one can

understand that among this large number of casuals were many queer characters, some of all sorts. A number were real out-of-work men, and glad of a job ; of the others, there were a few who could never keep to a regular job. A few weeks at one place and they would get tired, and off they would go elsewhere. Three or four, generally, were what the others called "rough 'uns." They had no regular home or lodgings, but slept rough, as it was called, lying down in any shed or outhouse for the night, where there was shelter from the weather. They could never keep any money, they had to spend it as soon as they earned it. So long as they got enough to buy a bit of food and some beer, they didn't mind ; they got some clothes somehow or other. These men were, as a rule, the fun-makers of the party, they were nearly always more cheerful than any others, and always making jokes, sometimes witty, but generally rather coarse in their ditties.

It is usual to begin work at about 6 or 6.30. On one occasion, even at this early hour, I noticed one of the men seemed very unsteady, and could scarcely manage to pull the roots, much less clean them and cut off the leaves. I watched him for a little time, and he seemed to get worse. I thought every minute he would gash his hand or otherwise do himself some injury. I stopped him working and told him he had better go and lie down a bit and sleep and come back again when he had got more steady. Of course, he was very indignant, said he was "Alright, how long had I blooming well been foreman ?" and a lot more. However, I persisted in him going, telling him he would cut his fingers off before long. At length he went ; he could not keep straight walking, so he started running down the field. He would go a few yards, catch his foot against a mangold, and down he would go. After a few seconds he managed to get on his legs again, he waved his hands and arms to the other men, flourishing his knife. This, of course, greatly amused them, causing great laughter, and so he continued until he was out of the field. I was thankful when he had got out of sight. Next morning he turned up at the proper time, this time quite sober. He looked rather sheepish, but as soon as he got the chance alone, he came to me and said, "I say, old 'un, don't take any notice what I said yesterday. I don't know what I said, but it was the beer I'd had." I expect he had been drinking nearly the whole night.

I remember one morning one of these men came to work very late, 10.30, I think. He was spoken to about coming so late. "Well, you see," said he, "I had to see about my bank affairs, and they don't open them places till between 9 and 10 o'clock." A photograph of the produce of two of the plots was one year wanted for some particular purpose. The produce of each of these particular plots were to be put respectively into heaps.

On the one they were all fine large roots, on the other, very much smaller. I set a man to make up the heaps of roots, and

stayed with him for a time, occasionally going again to him to see how he was getting on. When he had got the roots together into the two heaps, I left him to round them up. When with the other men I now and again glanced across the field to watch him. Some of the Laboratory staff were there with the camera, ready to take photos of the heaps, but I expect being deep in conversation, did not notice the man's movements. However, I noticed him go from the heap of small roots to the larger, twice, and wondered what he was doing. I left the other men and went across the field towards him. As I was going he again went to the heap of little roots and, being nearer now, I could see him pick up some of the lesser of these, intending to take them across to the heap of large roots. I shouted to him to stay where he was. When I reached him he had still the small roots in his arms. I said, "What on earth are you doing, fetching the roots from that plot?" "Why," said he, "I'm only filling in the holes between them big mangolds with these little 'uns. I'm a making 'em look ever so pruttty, to be took." What he would have done with the heaps if I had not noticed, I hardly know, but I made him fetch all the "little 'uns" (as he called them) back again to their own heap.

Standing by my weighing-machine I could often hear the conversation, though I never appeared to take any notice. I don't often join in any of the discourses unless appealed to. I never forgot once overhearing three casuals talking. One said to the other, "What do you think about doing this winter?" He replied, "I don't know whether to go to His Majesty's Hotel for a while; I havn't made up my mind yet." The third man didn't seem to hold with this hotel business, but the other said, "It's all right, if you mind what you're at; you get on A1 when you come out, a rattling good pair of shoes, and some new togs, perhaps."

I learned afterwards that His Majesty's Hotel was the name given to a prison or gaol, and the clothing, etc., given to prisoners when they had served their term was to enable them to start afresh and try to earn an honest living.

One of the regular men one day was met by a casual, who asked him if there was a chance of a job at the mangold pulling; he was told no doubt there would be if he came along that way. The casual enquired, "Do you have to have a character for that job, because if so," said he "it will be no good for me to come along, for I've lost mine."

One dull, gloomy day, during the course of the usual talk about the weather, one of the men remarked, "That'll get late proper early to-night, I'll warrant." I and several others caught the humour of the remark and had a good laugh over it. The speaker himself could not see what we found in his remark to laugh over. Often afterwards, when days were dull and dreary, this remark was quoted.

But the queerist of the queer characters was a man called by the name of "Dardell." I had never heard him addressed by any other name, and by that name had entered him on my time sheet. Then Mr. Eames told me his proper name was Fensome. He was a big, strong man, and would do almost any odd jobs, if others were with him, but if left by himself and had to think a bit, he was done ; he would then start whimpering just like a little child.

On one occasion at the mangold pulling I wanted (for a special purpose) the larger roots from some of the plots picked out and placed by themselves. I took "Dardell" along, and picking out a number of the roots, told him they were about the size wanted, that he was to pick out all roots about that size, and leave the small ones lying in their rows.

I left him at the job. I had got but a few yards away when I heard him begin to whimper and mutter. I stood still for a minute or so to listen, and as I stood I heard him saying, "How do I know which is big 'uns and which is little 'uns. I can't tell which they are, 'e ant ought to 'a set me at this job, 'e knows I 'ain't got no sense, I don't know which is big and which is little, boo'oo."

Presently I turned back and said to him, "That's quite right, 'Dardell,' you're sorting them out well ; go on like that." At this he was very pleased, stopped his whimpering and said, "O go on like that, orlright."

An aeroplane was passing over one day, and he could not locate it. The other men could see it, and they said, "Why, look, there it is, over there," indicating the position. "Dardell," staring about, said, "I can't see it. I can't see it in the right place, I can't."

One evening on leaving work he placed his cleaning knife under the tarpaulin cover of my weighing machine. As he placed it he turned to me, saying, "I'll leave my knife here to-night, and then if I lose it, I shall know where to find it."

He became ill, and had to be taken to the hospital. I suppose it was the first serious illness he had ever had. When he recovered and came back to the farm, one of the men asked him how he got on at the hospital. "Oh," said he, "I got on orlright, but they do some rummy things there. They put one o' they there 'mometer' in me mouth. I couldn't make it out. It was the fust time as ever I was an'lysed."

Now it so happened that in the mangold-lifting season of 1918 we had a number of German prisoners from the neighbouring camp at Hatfield working on the job. They came to and fro each day with their guard by the Great Northern Railway. They had not always the same guard. On one occasion the fresh guard was quite strange to the place, so that instead of he marching them forward, they had to lead him. They came to my house, and all halted

there until I was ready, when we all went off to the field together. We were all amused over the episode. These prisoners did their work very well indeed, and soon got accustomed to the plots. The guard finding he was not required to supervise, took himself off to the hedgrows, got under, out of the wind, lit a cigarette and enjoyed his reading of the morning paper. Our own men soon got used to the Germans, and by signs soon understood each other very well.

During a discussion going on one day about the war, I heard one of our men say (referring to the prisoners), "It 'ain't their fault, they didn't want to fight no more nor our chaps did, only the poor devils was made to." On the day of the Armistice everyone was very quiet, no jokes were bandied about as usual, the Germans seldom speaking, even to each other.

As the morning wore on and the eventful 11 o'clock approached there seemed to be an intense silence settling down over everything, as if all nature was listening intently for the all-absorbing verdict to be suddenly proclaimed aloud. However, as a matter of fact, we were some considerable time before we got to hear, and it seemed a terrible long wait. Being away in the field, we saw no one we could ask. At length I saw one of the church bell-ringers hurrying along the path on his way to the village. I sent one of the men to ask "What news?" He shouted back that the Armistice was signed. Our men turned to the Germans, saying, "It's all over." They cried out, "Fini, Fini," and began to caper round; one threw his hat up a tree, whilst the guard he threw down his rifle and danced the hornpipe. After the excitement had cooled a bit I called all our men together. I then asked them to lay down their knives and all join hands with me, forming a ring. Meanwhile the Germans stood on one side looking on in astonishment. I expect they wondered what was up. When we had all joined up, one of the men, named Lawrence, called to them, "Come in along with us." They at once came in and joined hands. I then asked all to join with me in singing the National Anthem, which our men did very heartily, whether in tune or not did not matter. I watched to see if the prisoners attempted to sing, but they did not. I have wondered did they know what we were singing? Most probably they guessed. They laughed and seemed very pleased it was as they called, "Finied."

Shortly afterwards Miss Wilson, of River's Lodge, came along, and after talking to me a bit she asked if she could be allowed to speak a few words to the prisoners. On being told that she could do so, she entered into a short conversation with them, speaking in German. They, of course, were very pleased to hear their own language, and most joined in the conversation. Our men listened in wonder. At length one of them nearest the conversing group turned to the others, saying, "Well, I'm blowed, why she a'talking to 'em in their own country like." Soon after this Dr. Russell

sent word to say we were to go on holiday for the rest of the day. I placed the prisoners on the odds and ends, where I knew they could not go wrong, and we others all went off, leaving them with their guard.

GEESCROFT FIELD.

Sometimes spelt Cheescroft (part of which is now the Geescroft Wilderness), the other part being down to grass. This field had experiments on leguminous crops, beans, peas, tares, clover, also barley. The last work I recollect doing in this field was sampling clover in 1885.

Up to 1874 the beans were dibbed in. After that always, I believe, drilled. In the old note-book a note is entered stating that twelve men and eleven boys were dibbing beans in Geescroft, November 17th, 1853. There always seemed to me something different about this field from the other experimental fields. For one thing, it seemed so isolated from all the other experiments, tucked away, as it were, in a corner and belted in on all sides by large elm trees; and then again, it always seemed of a wetter nature, a different variety of wild plants growing on its banks and in its ditches, more ferns, etc. This is the only field round here in which I have found the Hartstongue Fern growing in the hedgerows.

THE GRASS PLOTS.

With these experiments I very early grew familiar, having helped with the botanizing of the samples of grass from them, I soon became acquainted with the various plots; so that when the time came for me to supervise any work connected therewith I was quite capable of dealing with it. In these early days the operations of cutting, haymaking, etc., were all done by manual labour. Plenty of hands were available, and had been no doubt all through the years, for in the old note-books of "'52 and '53" I notice items to the effect that on such and such a day there were nine men, eleven women and one boy haymaking in the Experimental Grass. On another occasion it is noted that seventeen men, twenty women, and two boys were similarly engaged, and so on.

Both Sir John and Sir Henry were very reluctant to bring any machinery on to the plots. It was not until hand labour began to be difficult to obtain that the cutting machine and the hay-maker were allowed on regularly.

When first I had to do with the working of these grass plots the cutting was by scythe. Most of the men on the farm were good mowers, and nearly all of them were employed at the cutting.

Frank was the leader of the gang. He was called "The Lord." All had to follow his lead; it was he who decided as to how the crops should be cut, whether up, down, or across, according to the lay of it. Mr. Willis and I attending to the division lines, partings, etc.

In the first two or three years of my acquaintance with the experiments many women were engaged also at the haymaking, so I suppose the mode of working at this time was the same as had been practised all down the years.

Now these good ladies, whether married or single, were never addressed as Miss or Mrs., but were always called by their Christian names, thus:—Susan Crawley, Nancy Saunders, Betsy Belcher, Sally Bonfield, Tilly Ivory, etc. I knew most of them, and it seemed funny to speak to them in so familiar a manner; but I was told they preferred to be so addressed, so there it was.

At meal-times there was generally a good deal of chatter and merriment, especially at the mid-day meal, when each woman was allowed half a pint of beer. I think all the women drank beer, I do not recollect any teetotallers among them.

I always think of these early hay times as very hot, sunny and bright; surely the sun must have shone more and the heat been greater than during these later years (barring the past summer of 1921).

In my mind's eye I can see now those women and girls. They wore all sorts of wide-brimmed shady hats, a twist of gay-coloured ribbon round the crown, being the general style of trimming. Some wore dresses of cool-looking print, some of the older women also wore clean white aprons. I never see any of these picturesque costumes among the cottage women nowadays.

At the haycarrying I used to help Mr. Willis with the sampling, labelling, etc., whilst Knott attended at the weighbridge. Later on, I took Knott's place at the weighbridge, and again later, at Mr. Willis's death, I took over charge of the sampling, etc. I recollect that in the clearing of the plots at those early times, old-fashioned wooden hand-drags with stout wooden teeth were used. I call to mind one instance when we were all greatly amused. Some new hay rakes had been procured, the wooden teeth of which, I expect, had been made of comparatively new wood; being a particularly hot hay time, the teeth dried a bit, became loose, and were often falling out. The steward told a man named "R" to take the rakes to the farm, put the heads of them in water, and so give the teeth a good soaking to tighten them. Now "R." was fond of a pint or two of beer, and when told to give the teeth of the rakes a good soaking, he replied, "I don't know as it'll do 'em any good, master, for I often give mine a good soaking, and they still keep coming out."

Sir Henry would often come on to the plots after his customary daily call upon Sir John. He would come by the pathway through

the shrubbery, being thus but a few minutes' walk from the house to the plots themselves. As he drew near he, as usual, would shout for Mr. Willis, Grey, or Frank, so that we should be prepared for his coming and be ready to receive any instructions he might have to give, or answer any question he might wish to ask. When satisfied that things were going all right, he would walk slowly back to the Laboratory. Very often Lady Gilbert would accompany him when visiting the plots at the hay season.

Sir John himself used to come to us most days, but his visits were nearly always after tea or between four and five o'clock.

With regard to the plots themselves, a few changes have taken place in the manuring. No. 13, which used to be dressed with chopped wheat straw, besides other manures, now has fish, guano, and dung, alternately, every two years. Plots 5, 6, 18, 19, and 20 have also a different manurial treatment now. In the early '80's the lower or north end of the plots, for about 50 links up, received dressings of chalk; one lot was in a rough broken state, and another lot the next year fine and powdery. About the year 1883 ground lime was applied to one-half of each plot, and in 1887 to the other halves. The applications then being E. and W., those of late years being on the southern halves of the plots.

Later on, owing to encroachment by the growth of the lower branches of the trees on this north or woodside of the plots, the chalked portion was discarded; the wire fencing forming the boundary on that side was brought forward a bit and a new pathway made along the inner side of the wire, thus using up what was previously the chalked portion. For many years now the grass-cutting machine has taken the place of the scythe, each plot is lined out, and the machine cuts to within a foot or so of this division line, the remaining grass is then pointed out (or finished off) with a scythe. The haymaker and the side-rake or sweeper are also used at the making. By taking care that the partings and divisions between the plots are of a sufficient width, these various machines can be safely used, providing someone follows the machines on their rounds to see that the divisions are always kept sufficiently wide.

HOOSFIELD PERMANENT BARLEY, ETC.

These barley plots have been altered very little during the course of the years. One plot called "M" (nicknamed "My lady Em") has been discontinued, and the division paths between the plots widened, otherwise they are the same. Plot "M," which was triangular in shape, was situated on the far side at the extreme edge of the west side of the field. A narrow strip on all the plots of the ammonia or "A" series was for a year or two used by

Professor Armstrong and Dr. Ayres for growing flax and lotus corniculatus, for some special work they then had in hand. When the experiment was finished the strips again reverted to the barley plots.

For many years the crop was reaped ; later on, occasionally, when the crop was thin a rack-machine was used for the cutting. This machine was an ordinary grass-cutter, with the addition of a wooden rack fixed on the back. As the machine cut along, the barley collected on this rack. The machine was in charge of two men, one sitting in front driving the horses, and the second man in a seat placed for the purpose towards the back of the machine. This man was provided with a queer shaped wooden instrument having six or seven wooden teeth ; when he thought that sufficient barley to form a sheaf had collected on the rack, he pushed it off with this implement ; men followed behind to tie up. At the division paths all on the rack was pushed off, whether sufficient to form a sheaf or not, and so the machine was clear when it entered on the next plot.

For a number of years now the self-binder has been used, at first drawn by horses, but in recent years the tractor has been used for this purpose.

I have seen the name of this field spelt two or three different ways. In the old 1623 map it is spelt "Hosefield," and I have seen it spelt "Hoesfield" ; but Mr. Willis told me that the proper name was Hoofield. He said that it derived its name from a family who lived here some centuries ago, the head of this family being Peter De-Hoo. The ancient records or history of the family, I understood, were kept at the Rothamsted House.

The foundations, probably that of their ancient dwelling-place, can still be traced, and in certain seasons its outline is clearly defined by the difference in the growing corn. By the appearance of this outline the building appears to have been almost round in shape, extending for some distance into Hoosfield near the south-west corner, and for an equal or, perhaps, somewhat greater distance into Little Knott Wood Field, the present dividing hedge of these fields passing almost central through the circle.

Several gentlemen's seats round bear the name Hoo ; for instance, Luton Hoo, Kimpton Hoo, Lilley Hoo, etc. Mr. Willis said that no doubt at or near these places branches of the same family or clan lived in the bygone centuries.

Being some considerable distance from the Homestead, Hoosfield in my early years seemed to be one of the loneliest spots on the farm, but it always has had a fascination for me, my imagination being stirred by the tales told me. Besides this, I believe there must have been Romans living about this spot in very early times, for one often runs across pieces of old Roman bricks or tile when doing any soil work in the field. On one occasion A. Freeman, whilst working here, found a silver coin of one of the early Cæsars.

It was a beautiful specimen, in an excellent state of preservation. the figure-head, inscription, etc., being easily distinguishable. I cannot call to mind the date. However, Freeman took it to Sir Charles Lawes-Wittenwronge, who was then living at the Manor House, and Sir Charles gave him ten shillings for it, although the coin was found on his own estate. I understood that it eventually went into the collection of antiquities of the late Sir John Evans. In taking soil samples in 1913, when on the Plot 2 AA Silica, we came across a spot, when about a foot or so from the surface, where there had been a fire, and on another plot by the side of this plot I found several pieces of rough, unglazed, greyish looking pottery. Some of the pieces were plain and some had a rim, as if the whole had formed a small oval-shaped vessel of some sort. I thought probably that they were pieces of ancient pottery, so I brought some of them down to the Laboratory and Dr. Russell sent them to St. Albans Museum, asking the officials if they could say what they were. The answer was that the pieces were parts of a Roman cinerary urn. Nowadays the loneliness of this part of the farm has to a great extent disappeared owing to the carrying along near by of the branch railway to Redbourne, the gradual creeping towards this spot of residences as erected on the St. Nicholas Estate, and lastly, the erection close by of the Experimental Trust Farm, buildings and cottages.

One year in Sir Henry's time a number of soil samples from various barley plots in this field were taken for Dr. Bernard Dyer, A. Freeman and I doing the sampling. Dr. Dyer came with us to the field and stayed during the whole of the sampling. As we came away from the Laboratory hurriedly, we had brought no food with us. Sir Henry sent up luncheon, which, I remember, Dr. Dyer shared with us. We stayed but a few minutes at the repast and again set to work, so that we were able to take all the samples he required and get them sifted and bagged up ready for him the same day.

The middle portion of this field was devoted to leguminous plants ; clover had been grown here for many years. I recollect but little of these plots when carrying clover only, I became more familiar with them when various leguminous plants were growing. There were three series, running east to west, and they were divided into six plots running north to south, and on each plot was grown seven different varieties of legumes in strips some few yards wide, except in the case of Plot 1, Series 1. Here there were 30 or 40 small beds or plots, each being of two or three square yards in area. The soil of most of these had been dug too and manure added at different depths. On some the original soil had been taken out and replaced by rich garden soil from the Rothamsted Kitchen Garden. At the time of which I am speaking all these small beds were growing lucerne. It was a terrible job to keep all these various leguminous plots and beds clean. A tremendous lot of hand labour

was spent upon them, Frank and his son also spent any spare time they had working there. There was a foot grass path between each species of plant, and so when re-sowing and mending was required, the strips had to be dug up with forks or gone over with picks. A plough could not be used. A man named Burgess, who lived at the Park Lodge, spent nearly his whole time on these plots, weeding, cleaning, etc. Being such a lonely spot it was very seldom anyone passed along that way save on special occasions, so that he used to get what we now call "Fed up" with monotony; he got into the habit of talking to himself, sometimes quite loudly. I suppose he did it to hear his own voice for company's sake. Occasionally I had to go to the plots for samples or specimens, etc., and I remember one day that I went Burgess was there busy with his weeding. He did not see me, and when I got near I heard him talking to himself. "I can't stand it," he was saying. "No, nor I won't, either, I can't stick it. I shall tell him I cannot put up with it." By the "him" I concluded he meant Sir John. Not long after this Burgess passed away, and I could not help thinking how soon he had been released from his monotonous job. At the far side of the beds, on a spare piece of ground between Plot 6 and the hedge green, experiments were made with a new species of leguminous plant named *Lathyrus Sylvestris*. It reminded me of the old-fashioned flower that one sees in the cottage gardens called the "Everlasting Pea," only that the flowers of this plant were paler in colour. It was claimed that it would make a most excellent fodder plant, similar to Lucerne, equalling, if not rivalling, that plant in usefulness. A man brought the young plants to the Laboratory tied up in bundles. I went with him to the fields, and A. Freeman and I planted the young seedlings in rows, using long slender wooden dibbers for the purpose. As we were planting I expressed a doubt about them doing well, as I thought the ground too stoney. I remember the man replying that stones made no difference, when once the plants got hold they would devour stones, rock and everything else; but they did not. A few plants grew vigorously for several years, but the greater number died out very quickly.

Owing, partially, to the enormous amount of labour required to keep these leguminous beds clean, Series 2 and 3 were ploughed up, well cleaned, and then sown with wheat. I remember how very distinct the crops showed up according to the sort of leguminous plant that had been growing previously. Several wheat crops were taken, and each crop showed the distinctive mark more or less throughout, the previous lucerne plots being very noticeable

After these series of wheat crops, in the year 1904 the land was re-arranged, being then laid out in four long strips running east to west. Three were sown with oats, and in the oats, lucerne, red clover and alsike seeds respectively, and later vetches on the fourth. These leguminous plants were grown for several years,

being again followed by oats, afterwards by barley, as at present. I noticed in the barley crop of 1920 some few plants of melilotus lencantha (Bokhara clover) still growing after all these years, no doubt seedlings from the old melilotus plots.

I have good cause to remember these leguminous beds, for it was in connection with them that I was once called to account. This was the first and only time during all the years that I have had to "go on the carpet," as the phrase goes nowadays. On this occasion I sampled the wrong plots. Sir Henry gave me his instructions verbally, which was unusual; being so many plots and series, I got a bit mixed up, and so it happened I took samples from several of the plots not wanted and missed several of those wanted. I had to go down to his study about it and try to explain which were the plots sampled and which omitted. He got in a great rage and threw my papers the other side of the room. Lady Gilbert came in at the time, and I remember her saying very quietly, "Henry, dear, you should not get yourself into such a temper, you will make yourself ill; no doubt Grey misunderstood you." However, he never again mentioned the matter to me from that day.

Series 1 and also the small beds are now ploughed up and corn crops grown thereon.

WHEAT AND FALLOW (ALTERNATE).

Next to the leguminous beds came the alternate wheat and fallow experiments. A broad grass path of five or six feet dividing them, this path being now ploughed up. This experiment, with the exception of a little alteration in the width of plot, is the same now as when started in 1851.

POTATO EXPERIMENTS.

On the northern side of Hoosfield were the potato plots. Here potatoes had been grown since 1876. We at the Laboratory always looked forward to the potato harvest. Mr. Willis, I, and as many of the others as could be spared helped in the sorting, sampling, etc. As a rule it was very nice weather when this job was on, being generally toward the end of September or early October. In fact, I don't recollect any very bad seasons, probably I let the good ones fix themselves on my memory and gave the bad ones the go-by. Forks were used for digging, the lifting being very often done by piece-work, each man taking two bouts, and as they dug they left the potatoes in rows on the plots. These rows were first looked over for diseased tubers, a cart or carts then came along, and the larger or ware potatoes were thrown into the cart, which

when loaded was taken to the weighbridge. A sample of these larger or saleable tubers being taken as this loading operation proceeded. After this the whole of the remaining potatoes were picked up in baskets and brought to us for grading. We had large cloths spread on the hedge green, and used sieves of different sizes. The first one kept back any of the larger tubers accidentally missed when loading into the carts, the second retained those tubers suitable for seed, and the third retained the small or pig potatoes, the soil that collected on the cloth during the operation being taken back to its respective plot each time. Samples were taken from all these grades, making four from each plot, viz.: large, seed, small, and also diseased tubers if any. Besides our own men a few outsiders were also engaged, and three or four women as well. Tilly Ivory, Mary Ivory, and another woman were at nearly all these early potato harvests; some years Sally Bonfield also. When digging the potatoes by piece-work the men had to provide their own drink, and on one or two occasions I have known them to purchase a small cask of beer, which was brought into the field and placed on the hedgerow or in the shade of the trees, at meal-times the quantity required being measured out. Now this cask was very zealously guarded, and I have noticed many a longing eye cast in its direction as the meal-times drew near. I recollect very merry times at this potato work, especially at the mid-day meal. There were two men who used to make most of the fun, one a big strong man named Flitton, and the other a little slim man named Joey. Now the laughter was generally at the expense of Joey, but he didn't seem to mind in the least. Joey was a drover by profession, and had been often engaged to drive cattle, pigs or sheep to or from St. Albans Market. He was terribly bad on his feet, hobbling along very slowly. The owners of the animals used to say they knew their cattle were quite safe in his hands, there was no fear of their being over-driven.

One year a young soldier on furlough (some said he was a deserter) came to work at the potato lifting, and he worked in his regimental clothes. One day Flitton, who had also been a soldier, hit upon the idea of dressing Joey in the soldier's clothes and put him through the drills. So one dinner hour the transformation took place, and Joey appeared before us in regimentals. He had a mass of grey curly hair, and we could just see the soldier's little cap embedded in it. The scarlet coat fitted where it touched, being drawn in with the white belt; for a rifle or bayonet he was provided with a long iron spike, which he shouldered bravely. When he was told to march, face about, right, left, etc., he cut such a caper on his poor feet that we all became convulsed with laughter, a more comical figure, I think, I never saw. On this occasion I was obliged to roll about on the ground to get my breath, I laughed so much. Joey himself appeared to enjoy the drilling immensely.

Joey married somewhat late in life, and he was often teased about his courtship days. As far as I could gather it proceeded somewhat after the following fashion.

When his day's work was over he would in the evening often stroll into the cottage of a near neighbour named "Sally," a spinster getting on in years; her bosom friend was named Betsy, she was about the same age or perhaps a little older than her friend, and was generally at the cottage when Joey strolled in. So far as I could understand, no love-making in speeches or otherwise took place. Joey used to sit smoking his pipe, enjoying these good ladies' company almost in silence, they being mostly engaged in straw plaiting. At length Sally determined to find out his intentions, so one evening when Joey was paying his accustomed visit she said to him, "Which of us is it you reckon to keep company with? Is it me or is it Betsy?" "Why, you, of course," said he, and soon after "Sally" became Mrs. Joey. (That's the pretty little love tale as it was told to me.)

The potato samples were brought down to the Laboratory and chemical analysis were made in the juice and pulp of most of them, and in all the specific gravity was determined, a large, round-mouthed, lipless ewer being used for the purpose. These potato samples were continued until 1901. During the latter years they gave very poor yields, and so it was decided to sow barley for the crop of 1902, without further manure. I recollect that an enormous crop of barley was produced on some of the previously highly manured plots: 64, 67, 71, and on one over 72 bushels per acre were recorded. The sowings of barley, with an occasional oat crop between, have kept on until the present time on Plots 1-4. The other Plots, 5-10, had also barley for two or three years, after which clover was sown. One or two seasons the soils of these clover plots were inoculated with various preparations, Hiltner's, Moore's, and soil from other clover fields. These and also some sowing of Cow Peas (a plant I had never seen before) were carried on for two or three years, eventually the whole of the Plots 1-10 were again sown with barley, and generally barley has been sown each year up to the present time. We now call these experiments the exhaustion series, no manure having been applied since the potato experiments were given up.

LITTLE HOOSFIELD.

The main portion of this field, as I first recollect it, was divided into four large square plots, and as far as my memory serves me, barley, occasionally interspersed with clover crops, were grown. The triangular piece of ground on the upper or north side being used for experiments on green manuring. For a number of years now this field has been used for experiments on Manurial Residues,

being divided into forty plots, eight strips—five plots in each strip. the now spare ground on either side of the field being used for demonstration plots from time to time, the triangular piece of the north side being, at the present time, utilised by the Board of Agriculture for flax growing.

I remember on one occasion in Sir Henry's time soil-sampling was in progress, the usual box irons being used, the land having just previously being ploughed. A gentleman from London was desirous of seeing this soil-sampling operation, and accordingly a day was appointed for his visit. Now it so happened that there was rain or frost the night before the appointed morning, I forget exactly which, but I know that the soil became in a very sticky state. The gentleman arrived, shod for town, not at all suitable for coming into a ploughed field. He was accompanied to the field by Sir Henry, who was wearing thick soled boots, also leggings, and as was his custom, carrying a stout stick. The gentleman himself wore, I believe, low shoes. I recollect that he managed to get across the field to us at the sampling holes, but he had a terrible job to get back again. I think his shoes came off ; I know he had the greatest difficulty in getting back on to the hedge green, and he was in a plight about the feet when he did get there. Since then, whenever visitors arrive on a wet, dirty day, I invariably glance at their feet to see how they are shod.

VARIOUS FIELDS, VARIOUS EXPERIMENTS, ELECTRO PLOTS, ETC.

Most of the other fields on the farm were used in the experiments on different descriptions of wheat (the same that Frank used to call the " Marieties "). They were carried out in a different field each year. Sawpit, Harpenden, Rickyard, Long Hoos and Fosters were some of the fields so used, 20 to 30 different varieties of wheat being grown.

Of late years, and since the farm has been taken over by the Trust, many varied demonstrations and trial plots have also been arranged and carried out :—Chalking, liming, subsoiling, sludge, dung from heaps in the open and from other heaps under cover, straw manure, wheat after potatoes, the seed being sown with the soil in different states of cultivation, etc., also experiments on experimental errors, these being some of the many such investigations.

During the war years also many trial plots were set out in various fields to test the manurial value of by-products from munition works, and other trial plots with flue dust and also with slags of various grades have been undertaken. In some of the fields Electro Culture Experiments also have been undertaken by the Electro Culture Committee, under Professor Blackman, cereals,

clovers, and other crops being grown under this treatment. At the present time, 1922, these experiments are being conducted in Knott Wood and Foster's Fields.

One Saturday afternoon recently I was on the Redbourne train, and a party of footballers were in the same carriage. This branch line skirts the west end of Foster's Field, and as we passed it one of the footballers caught sight of the posts which support the wires over these plots. "Look there," said he, "there's where they're growing corn under electricity." Some few remarks were made on the subject, when one young fellow said, "I can't see as it is going to do much good." "Oh, isn't it, though," said the first speaker, "why they tell me that by using this electricity they can make wheat grow for a hundred years." I expect he had got a bit mixed up with this experiment and that of the Broadbalk Field.

THE GARDEN CLOVER PLOT.

Before I pass on to Broadbalk Wheat Field I must say a few words about the Garden Clover Plot. This, perhaps, is the least known of all the experiments ; being situated in the private grounds of the Rothamsted House, it is very seldom shown to visitors. During Sir John's life-time he would often take interested visitors to it and discuss various problems which he hoped to solve through this experiment. Since his death it is seldom visited by strangers. The area of this little plot is about 10 square yards, being enclosed by a wire fence about two feet in height. It is part of what was at one time the Kitchen Garden belonging to the House, the soil of which had probably been under ordinary kitchen garden treatment for centuries. When the pleasure grounds were extended, this part of the kitchen garden was included, so that this little plot is now in the pleasure garden itself, and I must confess it is a bit strange to see on the beautiful velvet lawn this bed of ordinary common-place clover, whilst near by are clumps of beautiful roses and borders of gorgeous herbaceous flowers. The gardeners have told me that Sir John visited and took more interest in this little lowly clover plot than he did in any of the stately flower-beds, although he was passionately fond of flowers.

The experiment was started in 1854, and red clover has grown continuously every year up to the present. This is a most remarkable and interesting fact, considering that in the neighbouring fields red clover can only be successfully grown about once in four years. During early years fresh seed was sown but seldom. I was told that in the first twenty years only five seed sowings were made. Later on, and certainly since I have known it, seed sowing has been much more frequent. In these latter times the bed has to be re-sown every year. There are very good crops produced even now. During

the year 1920 I gathered three fair crops, cuttings having been made in June, August and October. Very careful and complete notes were made every time cutting or re-sowing took place, and one can read in its history many incidents almost bordering on the pathetic. For instance, in one or two years, owing to severe weather, the plants nearly all died; in another year a mole entered and on one portion destroyed the plants, that portion having to be re-sown; and again one other year many plants were destroyed by a dog running about the plot and scratching after mice. I well remember this last incident. Sir Henry was much upset about it. Freeman and I had to cut some lengths of wire netting and so make a covering for the top; we had to fix it on at once to keep out this or any other sporting dog. This top covering lasted for some years, but is at the present time discarded.

In the late nineties, I believe in 1897 or 1898, it was noticed in the early spring that many of the plants, previously quite vigorous and healthy, became covered with some sort of whitish fungus, the foliage withered away, and the crowns became black and rotten. Some of these plants were taken up and forwarded to a Mr. Carruthers, who sent word that they were suffering from an attack of the fungus called "Sclerotina." I don't know if this was a new disease in these parts, but, however, the news caused something akin to consternation. All the plants were taken up and burnt to ash, and the ash afterwards scattered over the soil. The surface soil itself was also removed and carefully looked over for the fungus.

We removed the soil right away into the carpenter's shed and spread it out on one of the large long benches. Then we went through this large bulk of soil little by little, and with the aid of magnifying glasses and tweezers we picked out, I should say, about a quarter of a pint of the black sclerotina nodules. The soil being then returned, a fungicide was applied in the form of bisulphide of carbon, which we sprinkled sparingly over the soil, afterwards raking it in. The new seed was not sown until some weeks had elapsed. This seed came along well, but in the following year, symptoms of the disease were again apparent, and the same process was again gone through, but not nearly so much of the sclerotina was found as before. Other pests were found at this time, some of the plants being attacked by wireworm and some by the eel-worm.

I had never heard of the eel-worm before, so I rather think this pest must have sprung into unenviable fame about this time. When examining some of the clover roots for this worm attack, I remember Mr. Willis saying to me, "He's only a little mite, but he bears a terrific name, he's called '*Tylenchus Devastatrix*.'"

Beside our own garden plot, this pest was also about this time playing great havoc among the clover crops in the neighbouring fields.

I remember the celebrated entomologist (the late Miss Eleanor Ormerod), who was then living at St. Albans, coming to the Laboratory to consult with Sir Henry concerning this clover pest. I think I am right in this, although I understood Miss Ormerod's chief work and interest lay with the study of the ox-warble. This lady paid several visits to the Laboratory at this particular time, but she had also been previously, when she had brought over some excellent photos to show us by which the great damage to hides and leather caused by the ravages of the warble were clearly shown. I used to wonder at that time how such a refined and gentle lady could be so absorbingly interested as to devote her life's work to such obnoxious things as ox-warbles, eel-worms, maggots, caterpillars, etc.

The clover plot even now often suffers from attacks of the eel-worm or sclerotina, but never so severely as in the period mentioned.

THE BROADBALK FIELD : DESCRIPTIVE NOTES, TALES.

And now I come to Broadbalk, the world-famous wheat field, the best and widest known of all the experiments. Starting in 1843, it is now this present year, 1922, growing its 79th wheat crop in succession.

With this field, as with the grass plots, I very early became acquainted, and the first occasion is firmly fixed in my memory. It was in the autumn—probably that of 1874—and ploughing was in progress ; besides the two horse teams there was also a team of oxen ploughing. I had never before seen oxen actually working, and being quite a small lad and greatly interested, I stayed some little time looking on. These bullocks were large, brown in colour, and had horns of a great length. They were very docile and, I believe, were working with a wooden-framed plough.

This form of labour must have been in use many years, for in 1852 notes one reads of "Two pairs of bullocks and two pairs of horses at plough in Broadbalk Field."

These oxen were occasionally used at the carting during the hay and corn-harvest, but they were very slow and not very reliable at the job. It was no use trying to hurry them, they would go their own pace, and sometimes if tired would lie down. They made no fuss about it, but as one of the men said (in his queer way) when speaking about this habit, "They never said nothing, but just laid down." This has happened when the cart has been fully loaded, but I never knew or heard of any overthrow, because they would lie down very gently, and also rise very gently, always hind legs first, whereas the horse when down, if urged to rise hurriedly, flounders and strikes out with his fore legs, and always rises fore legs first.

At this time the whole area of Broadbalk (excepting the broad

green at lower end) was utilised for wheat experiments, the butts on either side being laid out in shorter plots; those on the north end were called "Harpenden Butts" and were numbered 0 and 1, whilst those on the south, called "Knott Wood Butts," were numbered 21 and 22. There were also on this south side two or three very small plots, named "Upper and Lower Knott Wood" Butts, and an intermediate plot between.

In 1885, after a fallow, one half of plot 1; that half next to the dung plot 2B was taken to make a new dunned plot which was called 2A, the remaining half of the plot being now called "The New Intermediate."

After two or three years' fallowing (I believe in 1887) a part of the ground on the south butt plots was used for experiments with an Italian wheat called "Pedal Wheat." I understood that the object sought by this experiment was, not the yield of corn, but to see if straw of a fine and pliable nature, suitable for making the superior straw plait known as Pedal and used for hat and bonnet manufacture, could be profitably grown in this country.

The crop when ready was pulled up by hand and stored under cover to dry, afterwards the ears were cut off and the straw weighed and sent to its destination, the ears were bagged up, and later the corn thrashed out and weights recorded. I only recollect of one year with this experiment. Then followed two or three years of Red Clover, Plot 0, on the north side, also being included in these clover series. Afterwards followed other experiments, including potato varieties, nearly 20 varieties, I believe; also sainfoin, lucerne, and the experiments with fruit trees conducted by Mr. Pickering and previously referred to.

The main plots were at this time in duplicate, thus 5A and 5B, 6A and 6B, and so on. A drill row space was left between the duplicates marking the divisions, a wider space being left between the plots themselves.

At the ploughing in the autumn of 1893 the duplicates, with the exception of 2A and 2B, were merged into one. The division paths were considerably widened also, and from this time onwards the plots have been known as Plots 5, 6, 7, 8, etc.

PREPARING AND PLOUGHING, ETC

As a rule, the land was ploughed twice, once immediately after the crop was carried and again later, some little time before the seed sowing.

Sometimes, however, according to weather conditions or the foulness of the ground, scarifying or scuffing was the first operation, and then generally only one ploughing took place, as much of the grass and weeds as could be being picked off by hand after the scuffing.

It can be readily understood that the preparing of the land on this and all the other experimental fields requires more care and tact than the ordinary farm land ; being only able to work the soil lengthways causes considerable care to be exercised, especially in the one ploughing, or the ridges of the plots are apt to get somewhat high. Very often, just before this ploughing, the ridges down the middle of each plot were opened and the accumulated soil distributed over the plot, thus bringing the land, after ploughing and harrowing, to the desired and almost imperceptible gentle slope to either side. Frank and his son usually did this job, but I have seen quite a number of men with shovels and forks engaged at what was called " Spreading the Ridges." In order that the proper plot measurements are ensured, short stout oak pins are sunk into the ground, in the exact centre of the division paths, both at top, bottom, and also across the middle of the field. These pins are at such a depth as to be out of the plough's way.

At times, such as ploughing, manurial applications, or seed drilling, these pins are unearthed and the exact plot area marked out ; it is very seldom we have to renew. They last for many years. One afternoon when ploughing was in progress, I was at the lower end of the field, and Sir John came along the lower path ; when near me he stopped and, leaning on his spud, shaded his eyes with his hand, looked at the teams as they were going very slowly up the field. At length, turning to me, he said, " Are they moving ? "

In October, 1919, the tractor was used for the first time in the field, being, with its accompanying triplex plough, used for ploughing operations.

I watched with great interest as it went spitting and throbbing on its way. As I watched my memory went back to the ploughing scene of that long-ago year when as a small boy I stood on about the same spot, watching with equal interest the quiet, patient team of oxen plodding along with their wooden-framed plough. The manner and process of the manurial applications having been previously described, I pass on to the seed sowing.

SEEDING.

The seed wheat used for sowing was always very carefully chosen, being obtained from the most reliable sources. Occasionally, however, when good crops were grown in the adjoining fields, a portion of the same was reserved and the corn used for the seeding of Broadbalk and other experimental wheat plots. This reserved portion was carried and stored away separately from the main crop, and as soon as convenient was very carefully looked over, ears of any variety other than the one required being picked out and put away. This reserved portion was then thrashed by itself

and bagged up for use. Sometimes there were six of us at this sorting, and I have known two or three women also to be sent to join us at the job.

Wheat from the crops grown on the plots was never used as seed for the succeeding year, nor is the variety always the same, one variety being grown for several years, then another sort grown. In my time I recollect first Red Rostock, Red Club, and Square Heads Master, Little Joss (one or two years only), and late years Red Standard.

LABELLING.

Fairly early in the spring all the plots in the various fields were labelled ; for this purpose zinc labels of the size and shape of large luggage labels were used ; on the one side was the plot number, and on the reverse side an abbreviated description of the manures applied to that plot. The numbers and descriptive letterings were painted on the labels, this work being beautifully done by Mr. Willis, who used a small camel hair brush for the purpose.

Loops of stout string (or sometimes short length of light chain) were attached to the labels, one end of the strings or chains being then nailed to the tops of stout wooden stakes of about four or five feet in height which had been firmly driven into the ground on the edge of each plot, the label itself thus hanging suspended from the stake, so that it could be turned about and easily read on both sides. This style of labelling, which was in use up to 1901 (the year of Sir Henry Gilbert's death), had its advantages and also its disadvantages. Its advantage was that a visitor to the fields, without book or guide, could know at once the manurial application of the plot on glancing at the label. The great disadvantage was that during storms or high winds the suspended labels were tremendously blown about and knocked this way and that way against the stakes, so that the painted lettering on both sides became wholly or partially knocked or scraped off. Sometimes, too, in a very high wind, many of the labels were torn from their stakes entirely. After these occurrences all damaged labels were brought down to the Laboratory, the lettering patched up, and the labels again attached to their stakes. Perhaps after a few weeks severe storms were again experienced, and again the same performance had to be gone through. These renovations were generally done hurriedly, so as to get the labels back in their places as soon as possible. I used to help in these, but my attempts at letter painting were very poor compared with those of Mr. Willis. In those days visitors seldom had descriptive reports individually, the present custom of providing each visitor with an annual descriptive hand report for use in the field was, I believe, introduced

during Sir Daniel Hall's directorship, whilst the present style of wooden slab labels, on which the plot numbers are boldly printed, was introduced by Dr. J. Voelcker when director *pro tem.* in 1902.

HOEING, WEEDING, ETC.

The task of weeding and cleaning the land of the permanent experimental fields has always been a great anxiety. In the first place, a year's fallow for cleaning purposes is here impossible, and again, in this wheat field as soon as one crop is off preparations have to be begun for the next. In the early years, I was told, good hand hoeing over the field was sufficient to keep the land fairly clean; but the weeds soon began to get the upper hand, for we find a note of June 20th, 1853, to the effect that one man and eleven boys were engaged pulling weeds in the Broadbalk field, also on the same day two men and twenty-seven boys at a similar job in the Hoos barley field.

In my early acquaintance of Broadbalk the prevailing weed pests were the wild oat (*Avena Fatua*) and burr barley (*Caucalis-infesta*). Often this latter was picked off by boys after harvest, the weed being of a dwarf spreading habit, and late in seeding.

The wild oats which were pulled up by hand during July and August were most difficult to detect until they began to show signs of seeding, being so much like the wheat plant. This pest must have been more troublesome in earlier years than even at this time, for we read that on July 20th, 1853, there were two men and twelve boys pulling wild oats in Broadbalk field; and yet earlier in August, 1852, it is recorded that sixteen men, two Irish women and one English woman were engaged picking the wild oats out of the Broadbalk wheat. This I take to mean pulling them out of the wheat sheaves, as we find that in that year the crops were cut the early part of August.

I remember that Frank with two or three other men had, towards the approach of the harvest, what they called "A week's oating." During this time the plots in this and all the experimental corn fields were carefully gone over, the wild oats pulled up and taken off. I have often seen Sir John, sometimes alone, at other times accompanied by one or two of his grand-daughters, in the evenings at this time of the year, very busily engaged at this oating job.

The persistent and terrible pest of the Broadbalk field at the present time and for many years past has been the slender fox-tail grass (*Alopecurus argestis*) or black bent. This troublesome weed was not much in evidence at the period of which I am writing. It was not until I had been at the Laboratory some years that I heard Mr. Willis speaking of it.

This pest soon began to get the upper hand of the hoers ; if hoed up during showery weather it started rooting again at once.

The hoeing operation began very early in the spring. I have known quite a gang of men, thirty or more, on this job, but, notwithstanding, they were not able to cope with it, that which remained seeding enormously. The fact that this weed could not be kept under caused Sir John and Sir Henry great anxiety, so towards the end of the "eighties" Sir John decided to try hand-pulling. I have seen quite the same number of men "grassing," as it was called.

This operation was very slow and required great care, for as the season advanced and the weed got more vigorous the roots of those actually growing in the corn rows became so entwined with those of the wheat that unless great care was exercised both would be pulled up. The men got completely fed up with this job. I have heard them grumbling and grousing about it often. "We can't see nothing else, only this blinking grass," they have said ; "we see it on our plates when we get home to tea and supper, and on Sundays it's in our eyes all day, and then on Monday morning here we are again."

I don't know if Sir John was told of their complaining, but, however, about 1890 a number of school girls were engaged to do this grass pulling. The men kept on with their hoeing between the rows, whilst the girls pulled out that growing in the rows of corn. I was told that Sir John had an idea that girls had keener eyesight and would be more careful over the job than boys. Being still school girls they could only come in the evening, but they came all day on Saturdays or any other holiday. A place at the farm was fitted up for them wherein they could have their meals and shelter from storms.

Now a suggestion was made that I should look after these girls at their work, but this I resented, being naturally of a very bashful and shy disposition, I strongly objected having charge of a lot of high-spirited young ladies, and I said so. The outcome was that the oldest girl was put as a kind of fore-girl over the others, and they were supposed to bow to her authority.

Each girl had to put the grass which she picked into a heap by itself. Very often Sir John came to them after he cam from town, bringing sweets (lollipops he called them), and the girls were given sweets according to the size of their heaps of grass picked out, the larger the heap the more the lollipops. I am afraid he very often got deceived. I fancy had he examined the heaps carefully he would have found there was not so much grass as appeared to be. Oh ! those girls were artful. One day, as I was passing near the field, I noticed them jumping and skipping about ; when nearer I stood and watched these unusual movements. I then could see that the fore-girl was teaching the others how to dance the keel-row. They were linking arms and twisting round,

in fact, having a regular Highland Fling. I thought what about the poor wheat plant. However, it soon recovered from the severe trampling, looking none the worse.

Sir John was very fond of these girls, and on the occasion of the Jubilee in 1893 he invited them to his private garden party at Rothamsted House; for this function they were given new dresses and hats. I remember the dresses were of a light blue material, the skirt, collar and cuffs being edged with red, and the large straw sailor hats were trimmed with bands of red ribbon and bunches of poppies and corn.

Many plans have been tried in the hopes of eradicating this most troublesome pest, such as thin sowing on one-half of the plots, the other half being sown in the ordinary way; the next year the order being reversed. This had a good effect for several years, but the grass began to again spread rapidly, so that in 1904 another plan was tried. One-half of the whole length of each plot was left fallow for cleaning purposes, the other half being sown with corn in the usual way, the next year the order being reversed, and again later the whole of the upper half was fallowed for cleaning, and the next year the lower; but still this particular grass has been, and still is, the bane of the Broadbalk field. During the last year of the war a number of soldiers billeted in the village were engaged in hoeing this and the Hoos Barley Field, the whole of the plots being gone over.

CUTTING, CARTING, ETC.

From the start of the experiments and up to the year of Sir John's death (1900) the wheat crop was reaped with sickles, many men being employed at the reaping. Frank has told me that it had been usual to engage a number of Irish harvesters for the corn harvest in addition to the regular hands, the cutting then being done in about two days. One year the whole was cut in one day, quite a host of Irishmen being engaged this particular year.

When I first had dealings with any of the harvesting operations the bulk of the labourers were regular hands, all of whom I knew personally. There were a few outsiders, the number of reapers at this time being much less than in early years, the operation now taking six, seven, or eight days, sometimes longer. The reapers were divided into two gangs generally, Frank being "Lord" over the one, and Alfred Freeman "Lord" over the other, Mr. Willis and the bailiff or myself supervising.

At the harvest of 1901 the self-binding reaping machine was introduced, drawn by horses. One year before the war and again during the war the whole crop was cut in one day, two reaping machines being engaged. Of late years the tractor has been used for drawing the reaping machine.

In the very early years I understood the produce of each plot was made into a small stack, placed on the broad green sward at the bottom of the field, each stack being opposite the plot from which its contents were gathered. The sheaves were counted when building the stack, and again when taken out for thrashing ; but this method of stacking had long since passed, the produce being stored at this time in the large wheat barn at the Home Farm, the left-hand side or mow being used for this purpose. This side of the barn had an earthen floor, whilst the right-hand side and the middle had concreted floors, which were always kept clear, these parts of the building being used during the thrashing. The barley was generally stacked in a small rick just outside this barn, thus being close at hand when thrashing operations commenced. At first the plots in the stacking were divided by layers of straw, generally oat straw divided the wheat plots, and wheat or oat straw the barley plots, but for many years now large sheets of coarse canvas have been used for this purpose.

This large barn had been fitted up as a gymnasium by Sir John for the use of his son, the late Sir Charles Lawes-Wittewronge, who in his younger days was a celebrated athlete. There was a scaffold pole for climbing from floor to ridge of roof, and a stout rope hanging from the rafters and almost touching the floor (also used for climbing) ; a giant's stride also and three trapees. We boys loved to get at that barn when it was clear, we have had fine fun there climbing and swinging. At stacking time these ropes, trapees, etc., were tucked away among the rafters, the corn being stacked round the climbing pole.

Those old harvest seasons were jolly times. I often think of them and of the reapers, nearly all of whom have long since passed to their rest.

Many of the men bore nicknames, and they were seldom called by any other ; others again were addressed by their Christian name, none by the prefix Mr. Of these nicknames I have forgotten most, but among those I do remember were the queer ones of Tarry, Crakie, Clipper, Steamer, Brusher, Crowie, Lindy, Underd, etc.

It seemed so comical to me as a lad when speaking to one of them to address him as Tarry or Lindy, Brusher or Underd, but such was the custom. And they were a jovial set of men were those reapers, always bandying jokes or trilling snatches of old songs. I fancy I hear someone say, " Oh ! that was the beer they used to have in those days made them merry." Maybe it did have something to do with the jollity of those times, and this reminds me that I ought to say a little about this beer, which at that time was an indispensable item of refreshment during the hay and harvest seasons. I fancy I can hear someone say, " Surely you're not going to bring beer into your narrative ? " But, oh ! yes, I must,

for the simple reason that it was a great factor, I might almost say the limiting factor, of the harvest season.

Of all the men engaged at the reaping I have only known one teetotaller. I have often known the men cheerfully stop a good bit overtime by the promise of an extra pint of beer.

There were two or three boys engaged who were called "Bottle boys," and their duty was to carry the beer to the reaping parties in the various fields for the meal times.

The said beer was measured off into wooden barrel-shaped bottles which were provided with light iron handles; when the required quantity was measured into them the bottles were hooked on to yokes fixed over the shoulders of the boys, who in this manner carried them to the fields. Each man was allowed a pint of beer at a meal, the two principal meals being breakfast at eight and dinner at one o'clock. There were also other breaks for refreshment at 10 a.m., 4 p.m., and again at 6 p.m. These intervals were called "beaver times." This term, "beaver time," appears to be quite local to this part of Hertfordshire. I have never heard it used anywhere else I have visited.

During the season there were, as a rule, several of the men in each reaping party who regularly carried small tin pots in their food baskets, and at meal times these pots were produced and used by the general assembly. They were locally made, and were obtainable from the little general shops, most of whom at that time kept a supply for sale.

These pots were supposed to hold half-a-pint, but were not guaranteed; woe to the shops that sold pots which were found to be radically deficient or, on the other hand, glaringly in excess of the half-pint measure. "Icabod" could be written over that shop so far as the sale of half-pint pots were concerned. I have known the men (when these defaulting pots have been discovered) to impale them on to the tines of a garden fork, with the remark, "They shan't make a fool of nobody else."

As a rule the man who poured out the beer at meal times had the first drink. The "Lord" or leader was entitled to it, but I never knew him to claim his rights. This fact of the so-called pourer out having the first half-pint was, I think, a bit smart, because by this means he was sure of his proper quantity, whether sufficient for the others or not. Each person had one half-pint at commencement of the meal, and the second when about half finished.

One day, just as the men were sitting down to their dinner, Sir Henry came along with a party of visitors. By the time the men had settled down and were about to pour out the beer the party were close at hand. One of the men named "Tarry Sygrove," called to the man with the bottle, "I say, let me have the first half-pint, then they (meaning the visitors) will think I'm Lord."

On another occasion great consternation was caused when it was discovered at meal time that none of the party had a pot wherewith to deal out the beer. Now here was a dilemma, the beer here and no pot to drink out of ; what was to be done ? At length a man named Baldwin said , " You needn't trouble anything about a pot for me, you give me hold of the bottle, my mouth holds just half-a-pint." Eventually a man was despatched to borrow a glass from the steward's house, and a vow was made that such a catastrophe should not occur again.

As the men were sitting one day at their four o'clock " beaver," Sir John came into the field and made his way toward them. When he reached Frank, who (as was his usual custom) had seated himself on the outskirts of the group, he said to him, " Why, Frank, you're always beer drinking whenever I come into the field." " Because you always come out about beaver time," answered Frank. Sir John made no other remark, but passed on.

Besides the usual beer, there was always a barrel on tap of what was called " Small beer." This was placed in the mess-room at the Farm, so that at any time the farm men, or, indeed, anyone passing could help themselves to this refreshment if they cared to do so. This custom of providing small beer " ad libitum " during the harvest season was in vogue at many of the larger farms round about.

I remember asking what this small beer was and how it was made. Not at first receiving an answer, I repeated my question. " Oh," said the man, " that there small beer, that's nothing much, only water, what they brewer's men washed their coarse aprons in and coloured it a little." I don't think I tasted any of that refreshment afterwards.

Mondays were very chatty days, nearly everyone having some tale to relate as to various episodes that had occurred during the Saturday night or Sunday ; of this or that old chum they had run across in this or that public-house, of friends seen on the Sunday, how they were getting on and what they were doing, and so on. Many of these tales were very coarse and vulgar, and would not bear repetition, but at others I was greatly amused.

One man told how unexpected visitors arrived at his house one Sunday morning and stayed on to dinner. As the dinner hour drew near his good wife became greatly perturbed, and said to her husband, " Now, here's a job, we haven't enough plates." The husband, who did not approve of this unexpected addition at the family dinner, replied, " Oh, yes, there's enough plates." Said the wife, " Don't be silly, I'm sure there's not enough. There's so many of us and so many of them, and we have only so many plates altogether." " There's plenty of plates, Missus," answered he, " there's too many people." This led on to another man called " Atty," relating how he also had met some friends from a neighbouring village, who informed him that they intended paying

him a visit some Sunday morning. "No doubt," said they, "you will give us a bit of dinner." "It's no use for you to think of coming to our place to dinner," said "Atty," "for our biler (boiler) only holds just enough for us."

One other of these domestic tales I recall, at which I was much amused, and which also caused much laughter amongst the company, being often referred to afterwards, particularly on Fridays. The man's story was to the effect that during the light nights he generally spent his evenings working in his garden, but on winter nights he usually went to the neighbouring public-house and had a pint or so, for, said he, "It's no good me stopping in the house, I'm only in the way, and there's no peace; sometimes I gets my chair up to the fire, but so sure as I do so, up comes the missus with her broom and says, 'Get your long legs out of the way, and let me tidy that hearth up a little. I can't think what you want to stop poking in the house for of a night, the children can't get near the fire nor nothing else.'" But on a Friday night, which was pay night, the wife's manner was different. She would then say, "Now then, you children, make room, so as your father can bring his chair to the fire; he's been working hard all day, and he's tired, so just shut up your row and keep quiet a bit, do." "I know what's coming," said he, for presently she would say, "You may as well let me have my money now, I want to pop along to the shop to get a few things." "Blow that, missus," said he, "I ain't had it many minutes (meaning his wages), dash it all, let me hold it a little while."

One harvester suffered much from bad feet; at times they were very painful. This man was well on in years, nearing 70 years of age. One morning, after a very painful time the previous day, he was asked if his feet were easier. "Well," said he, "they're not much better, but, lor, I don't know as I ought'er go on about 'em much, for yer know I've 'ad 'em a good while now."

Now and again tales of family quarrels were related, on one or two occasions (happily these were very rare), a man told how in the heat of the quarrel he had struck his wife. Most of the men disapproved of the severe measure meted out, but one or two approved, saying that no doubt she deserved it. One man named Charlie, who stuttered somewhat, showed his approval in a little speech something after the following fashion: "W-well, I myself re-re-reckons as 'ow a good s-slap o'-o' the 'ead now and ag'in ain't thr-oowd away" (meaning his wife's head, not his own).

A somewhat uncommon character was a casual who became known as "Holly Bush Jack." He was engaged on the hoeing of Broadbalk in the spring of 1911 or 1912, and continued working on the farm up to and throughout the harvest of that particular year. This casual was very tidy in his dress and clean in his person (which was not always the case with those of the mangold field). I never knew or heard this man's real name; the other men when

speaking to him addressed him as "Jack," but when speaking of him to a third person always referred to him as "Holly Bush Jack."

Now Jack lived the simple life absolutely. He took up his quarters in the clump of holly bushes growing under the oak trees in the south hedgerow of Broadbalk (hence the appropriate name given him). At this time there was a dense undergrowth of young holly and other bushes round about the foot of the oak trees. In the midst of this undergrowth was a clear space about 4 ft. wide and 5 or 6 ft. long, and this space he made his sleeping apartment. The far end and either side of the space he lined with sacking, fastening same to the growing bushes, placing a thick layer of dry leaves and grass within the enclosure to form his bed ; no covering was provided overhead save that of the thick leaves and branches of the trees above. Jack provided himself with a kettle, saucepan, some crockery, and various domestic articles for his use, also a large tin fish-kettle, which he used when washing his clothes. To amuse himself in the evenings after work he had a dartboard, darts, etc. On Saturday nights he did his shopping and paid a visit to some of the village pubs., when his dart-board practices were no doubt put to good account. Sundays he devoted to washing and mending his clothes, cooking, etc. He built his fire, did his washing, his cooking, and partook of his meal on whichever side of the holly clump happened at the time to be sheltered from the wind, and so throughout the months Jack lived this free and careless life, seemingly quite happy and contented. One Saturday night, toward the end of the harvest, after returning from the pub. he dropped some money among the dry litter of his bed, and struck a match to search for it. Perhaps he was none too steady just then. However it was, he dropped the lighted match among the dry leaves and grass, which immediately burst into flames. His bedding and drapings, his dart-board and other combustible things he had placed close by in a dry place were all destroyed, much of the undergrowth being also burnt away. He himself managed to scramble out somehow, unhurt.

Many of the men had, by some means or other, heard during the Sunday that "Holly Bush Jack's" place had been on fire, so that on the Monday morning he was greeted with the question, "Why, Jack, what'ev yer got burnt out ?" "Yes," said he, laughing heartily, "drawing-room, dining-room, kitchen, bedroom, carpets, beds, curtains and furniture, all the lot's burnt out, I shall have to start afresh." However, he renovated the place up a bit, rigging up the sleeping-place as before with dry litter, etc. He stayed on for some few weeks, but one morning he was missing from his place, and we saw him no more. The "call of the road" he had heard again, her call and lure were irresistible, she beckoned him, and at once he had answered and followed her, and so "Holly Bush Jack" passed out of our lives.

His quarters were, however, not long left vacant, being soon taken possession of by quite a different person or persons, viz., burglars. Some short time after Jack's disappearance the police came across a number of silver and silver-plated articles hidden in the litter of what was once Jack's bed. These proved to be part of the proceeds of a burglary recently carried out at one of the villas on the adjoining St. Nicholas Estate, the remaining portion, which comprised silver articles, small ornamental clock, etc., being found later on, hidden in the over-hanging grass of an allotment path at the back of the Laboratory. The police soon found these offenders, and they were speedily brought to justice.

GLEANING.

During the process of hand-reaping and hand-tying one can understand that some considerable quantity of wheat would get littered about the plots ; as neither horse-drag or hand-drag was allowed on the field, the only method of clearing it up was by gleaning, and for this purpose a number of boys were engaged each year.

This gleaning method, I was told, had been in vogue from the commencement of the experiments, and for many years one or two of the older men on the farm were told off at harvest time to supervise the job. Later on the man King from the Laboratory was sent to see to it.

On an evil day when "King" was from some cause unable to go, I was sent to take his place, and so it came about that at King's death I had to supervise this gleaning business entirely, although I was but quite a lad at the time. Sometimes when busy with other work I have been unable to go, so that either "Bigg" or "Bracey" had to fill my place, but the boys played up Hobb's diversions with these chaps, especially with Bracey, so that as soon as I could be spared Sir Henry would have me back again with the boys. Now of all the many and varied jobs I have been called upon to do or supervise this was the most worrying. I used to call this period "my fortnight in Purgatory." I'm sure all the sins I committed from year to year ought to have been wiped out by virtue of this gleaning penance. Being the school's harvest holidays, I think I could have had nearly all the small boys of the parish at the job had I taken on all that applied. I was allowed for this particular job to engage as many boys as I wished, but I limited my number to 24, and I found that number quite enough to deal with without being driven quite out of my mind.

Two plots were gleaned at a time, 12 boys on each plot. Each boy when he had gathered up his handfull of wheat handed same to me. When sufficient was collected to form a bundle it was tied up and put among the sheaves on its own plot, and so we continued

until the whole of the plots had been gleaned over. This gleaning, including that of the Barley Plots, usually took about a fortnight to accomplish.

The mothers generally came to me bringing their boy or boys with them, usually when I was at home, very seldom they came to the Laboratory. The usual way of applying was about like this. "Oh, Mr. Grey, I've brought my Bobbie, to see if you will take him at the gleaning. He's a good little gleaner, and he knows you, Mr. Grey." "Very well, Mrs. Twidell, he may come in the morning. My number will then be made up." Then his mother goes on, "You mind what Mr. Grey says to you ; and if he don't mind what you say, you give him a good hiding. I shan't mind, and I know his father won't mind, 'cos we know he won't get a whacking without he deserves it." And so she rattles on. Eventually she goes, and I am left in peace for a time, but not for long. Soon another rap comes at the door, this time another woman, perhaps, with two or three boys. "Mr. Grey, can you give my boys a job along with you a-gleaning. I do wish you would, I should know where they are then." (Yes, thinks I, so should I know.) "Well, Mrs. Pippin, I'm sorry, but I have got my number now." "Oh, do take 'em on if you can, for I'm sure if they're about home much longer they'll tear every rag off their backs ; what they school folks wants to give 'em all that long holiday for I can't make out. They're (meaning the boys) enough to worry me off me 'ead." (I thought how about me and the school folks.) As I have said, it was easy enough to get the boys for the job, the trouble was to get them to keep gleaning. They worked very well for the first day or so, but after that it was a difficulty to keep them at it ; they would do anything for a shuffle, up to all manner of pranks. I used a very long stick, so that by standing about half-way I could reach any boy along the line, giving a sharp rap if I found him missing the corn. I was not too severe, for small boys will be a bit larky, that is if they are in good health. I did not trouble about them laughing and talking a bit, providing they cleared up the wheat, but I had them always in line, not allowing them to run about the plots as they would liked to have done. At meal-times they gave full vent to their juvenile spirits. Such exhibitions of twirling, romping and tumbling were gone through, sometimes quite alarming, I used to think they would surely break their limbs. It was no use to tell them to rest themselves, they could not realize that all their romping and jumping during the dinner hour made them more tired for the afternoon. I often used to close my eyes and feign sleep. I had no occasion to look at my watch to know when the hour was up ; there would, perhaps, be a terrific din going on, when suddenly the noise would cease, they had heard the Rothamsted clock strike the hour. I have sometimes kept my eyes closed purposely for some few minutes just to hear the remarks. I've heard one say softly to the others, "Don't make

a noise, perhaps he'll sleep ever so long." "Shut up, Billy Tomkins, you'll go and wake him up, I'll punch yer ear for yer the 'reckly." When I opened my eyes they would all be sitting quietly, and I would be greeted with the words, "Mr. Grey, it's gone two."

But I could not help laughing sometimes; they were merry, happy lots of young urchins, full of life and fun, I loved to see them at their play. Most of these boys have gone from the village, but some few remain in their native place. These are now mostly married, with grown-up families, some even are far along life's road and have become grandfathers. Occasionally we have a little chat when we meet; the conversation generally ends up with a talk about the old days. They often say to me, "I shall never forget those old gleaning days, nor that stick of yours, either." Many amusing incidents occurred during these gleaning periods, one or two of which I often recall, being much amused when I think of them.

One occasion was when one of the boys named Arthur Day of a sudden started up, remaining standing perfectly motionless, staring into space as if listening intently. I spoke to him, asking what was the matter. He made no reply, but after a moment commenced to jump and twirl round in a regular frenzy, grabbing at his clothing, first in front and then behind. I spoke to him again, and again he did not answer, but stood motionless for a few seconds, then suddenly began twisting round as before. I concluded that something was biting or stinging him, and so when next he began capering I rushed to him and held him whilst I searched under his clothing. I found that a mouse had run up his leg, got under his clothing, and was next to his flesh. Every now and again the mouse would start creeping round his body, and as it crept it tickled him tremendously, beside giving a sharp nip occasionally. I was very glad when the little tormentor was caught, for I began to think the boy was going mad.

Another occasion was in connection with a boy named Willie Burgess. There was a wasps' nest in a hole in the ground on the edge of one of the plots. The boys knew it was there, but I did not, or I would not have let them glean that plot until the nest had been destroyed. However, the boys said nothing about it to me, and we started gleaning this particular plot, the boy Burgess being on the outside, almost in a line with the nest. As we proceeded up the field I noticed him making very mysterious signs to the others, so I watched to see what all this mystery meant. Suddenly Burgess took off his cap and flopped it down on the ground just in front of him, meaning to cover the hole of the nest; of course, he missed it, he himself stumbled and fell almost on the hole. Immediately the wasps swarmed out, many settling on him, stinging him somewhat severely. At once there was a stampede, the boys running in all directions. Burgess scrambled up, yelling

and buffetting, darting off after some of the other boys ; the faster he ran screaming toward them, the faster they galloped away. Poor Burgess was sadly punished. I did not add to it, but sent him home at once.

When the self-binder and reaper were brought into use, and the horse-drag used on the field, naturally this gleaning operation ceased.

HARVEST HOMES.

At length all the crops, both Experimental and Farm, are gathered in, and then followed the Harvest Home.

The old custom of celebrating the safe in-gathering of the crops with feasting and merriment was now fast dying out ; the practice of decorating the last load of corn with ribbons and green branches of trees, accompanying same to the homestead with singing and dancing, had died out altogether ; but at many farms, Rothamsted included, the Harvest Home supper was still held.

I recollect being present on three of these occasions. The first was in my very early years, when Mr. Hipwell was steward. All of us at the Laboratory were invited, and most accepted.

The supper was laid in the East Mow, or thrashing part of the large wheat barn, of which I have already spoken, the viands being prepared and cooked, I believe, in the kitchens of the Rothamsted House, close at hand.

The picture of this my first Harvest Home supper is vividly impressed on my memory. When I think upon the event, I see again the long table, loaded with huge joints of all kinds of meats, dishes of vegetables, and jugs of foaming ale, with all the jovial company seated on either side.

Mr. Hipwell (as steward) presided at the head of the table, his seat being raised somewhat above the rest. On either side of him were the guests of honour, including Mr. Willis, Mr. Archer, Mr. C. B. Kaye, Mr. G. Knott, and others from the Laboratory, also a few tradesmen from the village who did work for the estate : such as the village saddler, wheelwright, etc. ; also the butler, game-keepers, coachman and other estate or house servants, whilst several boys, including the "bottle boys" and myself, sat at the lower end. After the meal there was some speechifying, of which I can remember nothing. I was but a small boy, and thought the speeches very grand and so on, but this part of the proceedings impressed me least. These being over, we all settled ourselves down to enjoy the harmony and songs which followed. Oh ! I wish I could make you see that picture and all those ruddy, beaming faces ; it does one good to think upon it.

The beer passed freely, there was no lack of this refreshment ; a goodly supply of tobacco was also provided for those who smoked.

I noticed also that among the privileged few at the head of the table, special bottles which, I concluded, contained something stronger than beer, were often passed along from one to the other. There was also at that end a number of long-stemmed clay-pipes (called churchwardens) being used. Some of these long-stemmed pipes were also passed down the table so that any one could take one for his use if he wished, but very few of the farm hands took one of these, preferring to use their own short-stemmed clays (or nose-warmers), as they are usually called.

Mr. Willis, I knew, was a non-smoker, so I was rather surprised to see him with a churchwarden pipe in his mouth ; but one could see he was not accustomed to it, for the bowl of the pipe was generally upside down, and when he beckoned me to him to speak to me I noticed the pipe was empty, so I supposed pretence was made to use it just for sociability's sake.

There was no musical accompaniment to the songs, each singer pitched his own note. Frequently the tune was too high, sometimes too low, so that a fresh start had to be made. At nearly all these cases of miscarriage the would-be singer had to take a drink of beer before beginning again. "That's right, 'Lindy' or 'Jimmy,' whet yer whistle afore yer begin ag'in, you'll git on then," was the advice given.

At first it was somewhat difficult to get any of the farm hands to sing, and so Mr. Archer, I remember, sang "The Death of Poor Cock Robin." After him Mr. Kaye sang, and his song was just a repetition of four lines. I've always remembered those lines. They were as under :—

" Sandy he belongs to the Mill,
The Mill belongs to Sandy still ;
Sandy he belongs to the Mill,
And the Mill belongs to Sandy."

But very soon spirits began to rise, so that later on nearly everybody wanted to sing.

But the songs I liked best were those sung by the older farm men. Oh, they were ancient and quaint, nearly all had choruses in which the company were expected to join. Often this was but a jumble of queer words, such as "Wac fol th' rol riddle I doh," and such like. I noticed that during the singing of the choruses by the company the singer before beginning the next verse generally took the opportunity to "Whet his whistle." Many of the songs were old love ditties, and very quaint some of them were. I can only remember here and there a line or a title of these. One was about a young maiden as she walked out for to take the air, and the song goes on, "Three long steps and I stepped up to her ; she appeared to me like some vision fair."

There were songs about different girls, among others being "The Oyster Girl" and "The Watercress Girl," who (so the song relates)

threw over her lover and left him with a bunch of watercresses. "Down by the Shannon Side" was another little love ditty, and there were many others of like type.

Some songs ended up with old proverbs, such as "You never miss the water till the well runs dry;" and again, "There's many a dark and cloudy morning brings forth a clear and sunshiny day."

One morning, many, many years ago now, when taking the meteorological records, the words of this old chorus came into my mind, and I casually wrote them on the lead work of the large rain gauge on the right-hand side of the doorway, using the rain gauge key to scratch the words on the lead. I noticed the other day that the lines are still there, and fairly legible, though it must be over forty years ago since I wrote them.

John Barleycorn came in for his share of the honours, and his praises were set out in one or two songs, such as :—

" John Barleycorn was an hero bold
As any in the land," etc., etc.

And again :—

" Then here's to the Barley Mow, brave boys,
We'll drink to the Barley Mow."

I did not hear any song in the praise of wheat or oats or any of the other farm produce, and but two only which in any way described or referred to the actual farm work. One of these was "The Jolly Ploughman" and the other "The Farmer's Boy." As the evening wore on I and two other boys made up our minds to stay until the end of the proceedings, and then not to go home, but to pass the night in a straw rick near by. Accordingly, when the gathering was breaking up, we slipped away and ensconced ourselves in the said rick, where we passed the night, pretending we were as comfortable as in our own beds.

My people at home began to get a bit uneasy when I did not return, but concluded that the festivities were being kept up the whole night through.

Next morning, early, I turned up, looking, I suppose, somewhat seedy, and so ended the first dissipation of my life.

Whether or no these harvest suppers were held annually, I cannot say; if so, we at the Laboratory did not always get an invitation. The second invite we had was during Mr. Bird's stewardship. On this occasion the proceedings were held in a marquee erected in the little meadow at the back of the Rothamsted Cottage, where Mr. Bird was then living.

This time the repast was set out in a more refined style, something after the present-day fashion, and it was held in the late afternoon. Mrs. Bird and her two daughters, together with one or two other ladies, waited upon us at the table, and everything was very nice indeed, but much of the old-time merriment and jollity was missing. I remember that with the plum pudding,

brandy sauce was served ; most of the men were unaccustomed to this luxury, and in the fields some time afterwards, when the men were talking over the event, one of them said, "I wouldn't 'ave 'ad none 'a that there gruel tackle over my plum pudden if I'd a-know'd, for it reg'lar spielt it" (meaning the pudding was spoilt). Very little singing took place on this occasion, for the weather came over so bitterly cold that all were soon glad to get away into some more comfortable quarters. The only excitement I recollect was when a little man called "Stunty" announced the fact that he intended standing on his head on a chair, the ladies being specially asked to come and see this prodigious feat performed.

The third and last occasion was some years after, and during the time Mr. Osborne was steward. Here again we all at the Laboratory were invited, and again most accepted.

Now Osborne was one of the old-fashioned school, and so this harvest supper was served up in the old style (practically a repetition of the first), being again held in the old Wheat Barn.

Several of the older men who were at my first Harvest Home supper had by this time passed away, a few still were working on the farm and were at this supper. They sang again the old songs.

The younger hands sang mostly music-hall ditties, the old-time songs seemed to be rapidly passing. On this occasion I heard another song in praise of "John Barleycorn." This version represents him as a very cruelly used and oppressed person. I can remember but parts of the song, but the singer related in very quaint wording how (referring, I suppose, to barley-sowing time) "They cast 'im (meaning the barley) in the ground with glee, and crushed great clods upon 'is 'ead, and then they said 'e's dead, 'e's dead, John Barley-corn is dead." Next the singer told that "John 'e did spring up ag'in, and 'e did a-remaze 'em all." Later on (at harvest time, I suppose) it was told how "They 'ired some ropes from Man-chest-er for to bind 'im on the cart"; and later (referring to the thrashing) "there came two men with long crab sticks (meaning flails), and they thrashed 'im skin to bone, but the miller 'e served 'im wus'n that, for 'e ground 'im 'twixt two stornes."

Last scene of all was when the barley had been converted into malt and beer made therefrom. John's enemies "who partook too freely of the potion" were completely vanquished, for the last line of the last verse asserts that "John proved the strongest man at last." Whilst singing this last line the singer began to reel and stagger, pretending to be quite intoxicated, and at the very last word of the song he fell prone upon the floor of the barn. This tremendously dramatic act was received with the most uproarious applause. "Well done, Will, so John got the better on 'em 'arter all, 'ere, 'ere"; "Whet yer whistle, Will, 'ere, 'ere," was shouted from all quarters.

One other song, the curious wording of which I often recall, was that sang by the gamekeeper. It was all about birds, eggs, nests and trees, the words of chorus being something after the following :—

“ The egg was in the nest,
And the nest was in the bough,
And the bough was in the tree,
And the tree was in the valley low, low, low,
And the tree was in the valley low.”

And so my third and last Harvest Home supper passed. I was older now, and sleeping out in the straw did not offer any inducement to me this time. From the festival I went home direct.

THE WILDERNESSES.

But there was one year, viz., 1882, when the produce of Broadbalk was not all harvested. At the harvest of this year Sir John allowed a certain portion of the wheat at the upper or western end of the field to stand and shed its seed. There was an excellent crop this year, the variety, I believe, being club wheat.

I understood that Sir John's object in leaving this portion of the crop uncut was to ascertain how long the wheat plant would survive without man's intervention, or, in other words, when left to take care of itself, and also, further, to note the increasing fertility of the soil as the natural herbage established itself; analysis of the soil and herbage being made from time to time. No doubt but that birds and vermin had some of the shedded corn, but still, in the following year, 1883, there was a very considerable plant, probably half a crop, which was again allowed to ripen and shed its seed; but from this time the wheat died out very rapidly, driven or choked out by the ever-increasing variety of plants taking possession of the ground, so that at the harvest of 1886, after searching all over the allotted ground, only three or four stunted wheat plants could be found, and these were such thin and miserable looking specimens that one could hardly believe they were wheat, had it not been for their little stunted ears of corn, the land having now become covered with a host of plants composed of various grasses, clovers, weeds, and seedlings of shrubs and trees.

A bit later on the land was divided into two parts. On the southern half the shrubs and saplings were, and are still, allowed to grow, whilst the northern half is gone over from time to time, and the shrubs, bushes, and tree seedlings removed, so as to allow the grasses, weeds, clovers, etc., to establish themselves and develop unhindered. This reserved portion is now known as the Broadbalk Wilderness.

At the present time (1922) the southern half of this wilderness is covered with a tall dense growth, mostly composed of nut-hazel stems, hawthorn and wild rose bushes, with here and there young trees, mostly ash, to the almost total exclusion of any grassy undergrowth, ivy trailing over the ground being about the only plant growing at all freely in the somewhat deep shade, so that this portion is now practically of the same type as the ancient game preserves near by.

On the northern half, where bushes and seedlings are kept down, a thick and vigorous growth of miscellaneous herbage has become established, numbering at Dr. Brenchley's (botanist) last examination, 65 species.

A few years later, viz., 1885, a portion of the Geescroft Field was also fenced off and left uncultivated, the object being for the same purpose as that of the Broadbalk Field portion already described, but with the difference that Geescroft was at this time under clover, excellent crops of which had been gathered both in this and the preceding year. This reserved portion is now called the Geescroft Wilderness.

The change from highly cultivated land back to the wild state has, through the years, been most interesting to watch. On the Broadbalk land the species taking possession were, as before said, of a very mixed character, and as the years passed on first one and then another of the species have taken the lead; but the soil of Geescroft being of a much wetter nature, the vegetation establishing itself thereon was, and is now, very different, both in species and order of predominance, one particular species of grass, known as "Tufted Hair Grass" (*Aira Coespitosa*), quickly asserting itself, becoming and remaining predominant, whilst the original clover plant almost as quickly became extinct.

At the time of writing I notice that this "Tufted Hair Grass" has monopolised quite two-thirds of the area, growing strong and vigorously in huge tufts.

With the shrubs and tree seedlings also the progress of establishment has been very different.

Here, on the east side of Geescroft Wilderness, where the boundary is a hedge-row wherein are growing many large elms and a few oaks, a space of about fifty yards extending inwards has become thickly studded with young elms and oaks, under the shade of which the "Tufted Aira" still persists to grow though in comparatively small weak tufts.

Close up to the iron boundary fence on the west for about five yards inwards a belt of trees and shrubs of great variety also have sprung up: Oak, Ash, Wild Cherry, Silver Birch, Hawthorn, Wild Rose and several other sorts. In the open space between these two belts is the vigorous growth of Tufted Hair Grass I have mentioned, this being here and there dotted about at irregular intervals with young trees and shrubs of various kinds, including

Sallow (English Palm), Dogwood, Hawthorn, and two or three Nut Hazel stems. The young trees are mostly growing singly; such being the case, they are, as a rule, of good shape, especially the oaks, they being able to throw out wide-spreading branches unhindered, whereas the young trees in the Broadbalk Wilderness have had to fight their way through and above the dense nut-hazel growth before being able to throw out branches of any length.

BOMBING.

One other incident in the history of Broadbalk I must mention before I pass on to the final, and that is the bombing which occurred during the Zeppelin Raid in the early morning of September 3rd, 1916.

Whilst lying in bed I heard the buzz of the Zepps, and soon after the thud of a bomb as it struck the earth, and we also felt the house tremble a bit. But I did not get up just then, I thought, though we could hear the hum of the Zepps, that they were far away, I never for a moment dreamt they were as near to us as they were.

However, very soon a man from the farm arrived in a state of great excitement to tell me that a bomb had been dropped in the Broadbalk Field and that some of the wheat was buried in the *debris* of clay and earth thrown up (the corn being at this time cut and standing in shocks or stooks).

I at once went up to the field, and found that the bomb had fallen upon No. 6 Plot, making an enormous hole 11 ft. deep and 18 ft. across, much of the soil and clay being thrown up in large boulders.

The shocks of corn on either side were buried in the *debris*, but with help I was able to unearth them all, and these, together with other shocks near the hole, I caused to be moved further up or down the field, out of the way of pilgrims, who soon began to visit the scene in large numbers from all the surrounding district. A few panes of glass were broken, and the brickwork of the farm cottages near by chipped about a bit, but beyond that no other damage was done. The inmates, of course, were terribly frightened, and fled from the houses in terror, but they escaped any injury; other bombs were dropped in the fields of a neighbouring farm about a mile away.

Now why on earth did the Germans bomb Broadbalk? Was it jealousy because this field was first and foremost of the experimental fields of the world? I think a more likely theory is that these Zepps had evidently lost their way or had been driven out of their proposed course; as they passed over the field,

the rows of shocks standing in the moonlight may have appeared to them from the height above like rows of soldiers' tents, and they may have thought they had spotted a military camp.

THRESHING.

And now we come to the threshing, the last process of the harvest year. As before stated, this operation took place as soon after the ingathering of the crops as could conveniently be arranged, in order to get the results for Sir John's annual wheat letter, and, as also before stated, the threshing always took place in the old wheat barn.

The use of the flail for threshing purposes had at Rothamsted ceased for many years, but the old winnowing fans and caving sieves used at that period were still about the barn when first I helped at the threshing job.

The threshing machine now in use was called a Boulter. I was told that this machine had been specially made for Sir John for the threshing of his Experimental Plots. It was very simply made, the interior workings consisting of drum and beaters only, the outer frame being so constructed that sections of same, at front, back and sides, could be opened and the drum easily got at if desired, and also the whole interior easily cleared of lodged grain, etc. This machine did the threshing part only; as the sheaves were passed through, the straw was delivered on to a sloping rack at the front, whilst the corn, chaff, and cavings fell on to a sharply-sloped board at the back, from whence it slid down on to the cemented floor.

A man removed the straw as it gathered on the rack, shook it well to free any loose grain which might be lurking amongst it, and then passed it over the door board on to large spreaded cloths, where two men received it, and tying same into bundles, loaded it on to the cart which stood close at hand; at the same time another man stood by and sampled the straw as the threshing of the plot proceeded, each load of straw when ready being taken on to the weighbridge (which at that time was quite near the barn), weighed, and the weight recorded in the Harvest Book.

The so-called doorboard, which was about $2\frac{1}{2}$ ft. in height, was common to all these large wheat barns. They were the full width of the doorway, and were placed along to prevent as much as possible any loose corn or flying grain from the flails or machine to escape outside the barn. These boards could be easily lifted and removed out of the way, should occasion require, being fitted into slots fastened on to the door-posts, the large spreading cloths just outside the doorway which were always used when threshing the experimental crops being a still further precaution against loss of corn, etc., during the threshing and straw-tying process.

At the finish of each plot the doorboard was lifted, the cloths drawn in, and any corn, cavings, chaff, etc., which may have collected on them cleared off and put with the rest of the produce, the cloths being then re-spread ready for the straw of the next plot.

The thresher stood on the middle cemented floor just inside the barn, opposite the huge double doors ; here it stood year in, year out, being used solely for the experimental work.

The driving power was obtained by means of an old portable steam engine. This was a very old affair belonging to a man named "Morley," who himself told me that he had bought it second-hand, together with its accompanying threshing tackle, so that it must have seen many years' service before he acquired it.

Morley, in his younger days, had been in service at Rothamsted House, and when he left there he bought this engine and threshing tackle, starting business on his own, going about from farm to farm in the near neighbourhood during the threshing season, the whole affair being drawn from place to place by horses. No brakes or slides were provided with this, so that when going down a hill of any steepness it was the custom to unyoke one or two of the horses from the front and hook them on to the back of the machinery, facing up the hill, so that when the machine was going down the hill they would pull against it, and so steady it to the bottom, the engine and thresher each being taken down separately.

I remember this engine used to leak pretty freely, and had been patched up here and there. The men on the job used sometimes to remark, "That blooming old engine will bust one of these days, and we shall be blown to smithereens."

However, Sir John always took great interest in this man Morley, and had the hire of his engine as long as it was at all fit for use.

At the threshing of the farm crops all his tackle was hired, but for the experimental plots the engine only, the actual threshing being done by the special machine previously described.

Moreover, "Morley" was allowed to store his machinery, when not in use, in the sheds at Rothamsted, as he himself lived in quite a small cottage, with but very limited outside accommodation.

As the years passed by it became absolutely unsafe to use this old portable, and so a self-propelling steam engine of latest type was thenceforward hired. Morley then retired from the threshing world, being by this time far advanced in years, but if occasional help was needed at any of the work going on he would often lend a hand.

By this time two or three people in the near neighbourhood had started in the threshing business, each with a set of the latest and most up-to-date machinery ; they with their steam engines were able to cover a far larger area than Morley with his portable, and so they travelled many miles visiting the various farms, as they do at this present time.

It became usual, and still is the custom, for a certain number of men to follow these threshers from place to place, the same men attaching themselves to the same machine throughout the season, assisting at whatever job the machinery was required for, threshing, chaff-cutting, seed-drawing, or what not.

At times I have missed seeing certain men about the farm here, and on asking "What has become of so and so, I haven't seen him lately, what's he doing now?" the answer often has been, "Oh, he's doing nothing particler, he's took to 'follering the 'chene.'" (following the machine).

It was about this period that farm hands were noticeably declining, and so the accompanying casuals attendant on the thresher were, as a rule, taken on to assist at the work. On the larger farms they made up for the depleted number of regular hands, whilst on small farms and homesteads they saved the holder much trouble, he not having to search about for labour for this job. The regular hands at Rothamsted, in common with other farms, being now somewhat diminished, it was usual to take on the men attached to this particular machine, which was one hired from a man named "Munt," of Sandridge.

Although these casuals were taken on, they were never allowed to have charge of any important parts of the operations; Munt (if not attending to the steam engine himself) had his own man for the purpose, also another of his regular men—known as a feeder—sometimes took over the job of feeding the thresher.

Frank and his son Alfred, together with a man named "Rowe" (who was accustomed to help in any work on the Experimental Plots), having stacked the plots, always also did the unstacking; no other men were ever put on this job unless one or the other of the former were in charge. Besides the men mentioned earlier as attending to the straw, etc., at front of the thresher, there were also two others at the back, attending to the corn, cavings, etc.

As this rough mixed produce collected on the floor it was pushed across to a caving machine which stood on the edge of the dressing floor, as near the thresher as it could conveniently be placed.

Two men were also in attendance here, feeding the machine from the heap of corn, cavings, etc., pushed towards it from the thresher.

Behind this caving machine were placed two huge baskets about 5 ft. in height and of the shape of waste-paper baskets, into which the cavings, chaff, and all rough stuff was blown as the fans of the machine rapidly revolved; the corn being delivered fairly clean. Close by stood a small beam scale for weighing up the rough cavings as baskets became full. Further down the floor, and as far away from the dust of the machines as possible, was placed the dresser, through which machine all the corn was finally passed before weighing up. Together with this dresser were the

measures, also a wooden strike, and near by the corn weighing scales.

This strike always took my fancy, it was a smooth, round piece of wood about as thick as a man's wrist and perhaps 2 ft. long, having by constant use become highly polished, shining like glass. It was used to level off every bushel of corn before weighing.

Two of the oldest and most reliable farm hands were engaged here. In past days, when the threshing was by hand and flail work, these men were called "Barntaskers," and it was a pleasure to see them at their work, always so particular were they that their part of the floor should be spick and span, free from all dirt, etc. Whilst the bushel measure was being filled, by no means had it to be moved, knocked or shaken, because any jarring upset the true weight and measure. These men always filled the bushel very gently, letting the corn slide from off the corn shovel, never putting it in with a sudden jerk ; with them the striking business was considered very important, all corn at that time (and, indeed, up to quite comparatively recent years) was sold by measure. I often wondered how many years this particular wooden strike had been in use ; the men didn't know, they had used it, they said, ever since they had been at Rothamsted, which in their case meant practically their whole working life. However, they had a very natty way of using it, and with one sweep of it would level off the bushel of corn perfectly.

Mr. Willis was in charge of this final dressing, weighing and sampling of the corn, whilst I recorded the weights of straw, chaff and cavings, assisting him also at the corn sampling and weighing between times. When the produce from a plot had all passed through the thresher, steam was shut off and the whole affair stopped ; the platform of the threshing machine was then swept down and the interior cleaned out, a bunch of slender twigs being always used for the interior cleaning, as most suitable for reaching any awkward crevice or corner where corn might happen to have lodged.

When this job was finished the whole middle floor was swept, the sweepings passed over to the caving machine, and at a given signal from Mr. Willis steam was turned on, and the next plot proceeded with.

In early years every part of the crop was sampled, corn, dressed offal, rough offal, straw, cavings, chaff, etc., but this practice was after a few years discontinued, samples of the corn and straw only being from thenceforward taken.

At one time Mr. Willis and I spent some considerable while getting out and looking over these old samples. Mice had greatly damaged most of the caving and chaff samples, weevils having also attacked the offals, so the whole lot had to be emptied away.

When barley was being threshed, another machine, called an

"Ailer," was brought into use, two more men being in charge of this.

As the barley grain was delivered from the thresher and also from the caving machine, with most of the "Ails" or "Awns" attached, the process of what was called "Ailing the Barley" was completed with this machine. As it was fed, the grain on its way to the outlet had to pass between a series of slowly revolving, short, blunt, iron knives or spikes, so that by the time the outlet was reached all the "Ails" or "Awns" had become broken off, the grain itself being undamaged. Afterwards the barley was passed through the dressing machine, same as the wheat, for final cleaning.

Threshing is at all times a more or less dusty job, even out in the open, but when the whole operation (as in this case) was confined within the barn, one can conceive the appearance of those hands working in the near vicinity of the thresher; toward the end of the day's work they appeared to me like gigantic cobwebs moving about. One of the hands who for two or three seasons worked at the back of the threshing machine was an elderly casual. He had a rather long grey beard and a shock of rough grey bushy hair, upon which he wore an old slouch hat, generally tipped well over his eyes. This man always appeared more dusty than the rest of the hands, and as the day advanced seemed to become almost covered with dust, fluff and downy matter. For use at his job he had a short-handled wooden rake, with the teeth of which he raked off some of the loose rougher cavings, and then, turning the rake over, used the back of it to push the heap of rough corn, etc., towards the caving machine.

This old chap as he hobbled about appeared to me like a veritable "Rip-van-Winkle." I used to think of the short rake as his old gun, and with a very little stretch of the imagination could easily picture him as "Rip-van-Winkle," just awakened out of his long sleep; but I never heard the man complain of the dust at any time.

At meal times most of those engaged on the job assembled in the mess-house, in the centre of which stood a good-sized flat-topped stove, with a gentle upward sloping pipe leading into a disused chimney, and on a cold day the place was warm and comfortable.

When all (including men working at other jobs on the farm) were congregated here for their meals, the place very soon became full up and every available seat quickly occupied, so that sometimes I have found myself crowded out.

On two or three of these occasions, when the weather was very cold, I remember taking my food and going into the cattle-yard, where the working bullocks were lying in the straw, resting. They were very tame; I seated myself in the straw, leaning my back against the body of one of them, by so doing the warmth of the

animal's body was imparted to me, and in this way I kept nice and warm during my meals. The beasts themselves just turned their heads and looked at me with their great velvet eyes, as much as to say, "Oh, it's you, is it; we're not frightened of you, get on with your meal," and then took no further notice of me.

DUMPLING DAYS.

Mondays and Thursdays the men called dumpling days. At the mid-day meal on these days such an array of these articles of diet were displayed as I had never seen before, nor have I again seen, since those old threshing days.

As the dinner hour drew near the top of the mess-room stove became covered with dumplings, others also were arranged along the sloping stove pipe, and so they were left to hot up for dinner, someone going in every now and again to turn them over, so that they should get thoroughly heated through. I used to wonder how each man would know his own dumpling; to me they seemed so much alike, but I saw that, like sheep, each knew their own lamb.

Very few of these so-called dumplings were round, they were mostly crescent-shape, like cherry pasties, the crust being what the men called "Twiddled" (or pinched over) along the top in a similar manner to them, the cooking of all having been by boiling.

The crescent-shaped ones were never tied in pudding cloths, how the good wives managed to boil them without the crust breaking I don't know, but they did it. One of the old farm men said to me not long ago, when talking of the dumpling days, "Women nowadays can't boil a dumpling without tying it up in a bit of rag."

In the days of which I am writing an oven grate in a cottage was almost unknown, nearly all had open grates, so that all food had either to be boiled or roast in front of the fire, save the large batches of bread, these being usually baked in large brick ovens, one of which was generally attached to each row or group of cottages for the common use of the cottagers. Sunday was the only day in the week when the men on the farms were able to be at home with their families to meals, and so Sunday was made a big cooking day, the wives taking the opportunity of making extra dumplings to put into their men's food baskets for the morrow; and again on the Wednesday, when the food cupboard had to be replenished, was extra food cooked for the following day; and so it came about that Mondays and Thursdays had this special name assigned them.

One of the casuals who for several seasons came on at the threshing was a little dark man, with black bushy beard; there seemed to be something peculiar about this man which always

attracted my notice. He used to bustle about, generally singing or humming a tune as he worked.

One day I asked one of our men who and what he was? "Oh, that's old so and so (mentioning a nickname, which I have since forgotten), 'e 'allus follers this 'ere 'chene (he always follows this machine); 'e's a rum covie 'e is, why 'e sold 'is missus t'other week to 'is mate for arf-a-crown." "Sold his wife!" said I in astonishment, "but he can't do that, it's against the law." "Ah, but 'e 'ees (he has)," said my informant, and so I didn't argue more. But still incredulous, I asked further, "Don't the men quarrel when working together?" "Quarrel, lor no, they're right enough," I was assured.

I understood that the husband asked the wife if she liked his mate better than himself, and she said she did. "Very well," said he, "I'll sell yer to 'im for arf-a-crown." And so it was settled, the one handed over the half-a-crown and the other the lady. I thought to myself, what a simple affair, no law court or costly divorce proceedings, all so very simple. Some years after, when passing through the village, I saw a man approaching, wheeling a roughly made truck, the front and sides of which were adorned with those old-fashioned wind-mills, made of laths and highly-coloured wall-paper (the kind which used to be so beloved of the cottager's children), one of which could be had for a bottle or a few rags.

As I passed I glanced across at the man, and instantly recognised him as he who in the threshing days had sold his wife for half-a-crown. I wondered had he since repented of his bargain?

With the dawn of the new era the use of the old Boulter thresher ceased, the newer threshing tackle, as well as the engine, being now hired, the threshing operation taking place in the open.

This hired machinery was used for some few years, being afterwards replaced by new thresher, straw-tyer, etc., purchased by the Trust, the driving power also being obtained by means of their own tractor.

When using this machinery one is unable to clear out all the crevices, etc., each time, as was the case with the old, but by exercising care and attention quite reliable results are obtained. The method adopted being, first of all, to pass through the thresher a fair load of odds and ends of the same variety of corn as that of the plots about to be threshed. During the threshing of this, all crevices or corners wherein or upon which any corn could lodge, became and remained filled up. At the finish of the load the thresher is allowed to run ten minutes or so, so that the body of the machine clears itself. After this the plots are proceeded with, allowing the same time between each plot for clearing as between odds and ends and the first plot.

This now brings me to the end of my reminiscences concerning the laboratories and fields. One can see by them that practically

the whole of my working life (now rapidly nearing the half-century) has been spent in the service of the station.

I very early saw that care and attention was needed in all work carried on, or using the words of a well-known author, I quickly realised "The Importance of being Earnest," and so I resolved that whenever I should be called upon to undertake any duty, I would perform same to the best of my ability.

I have with pride seen the gradual growth of the station from those early times, having always been zealous of its reputation. Nor do I think it presumptuous or in any way self-congratulating to think that possibly by the conscientious performance of those many and varied duties entrusted to me throughout the long period of years I may have, in my humble sphere, helped it on a little towards the attainment of its present world-wide fame. But before I finally close, it is almost imperative that I should in these reminiscences mention the Rothamsted Allotments and Club. In early days these were so closely bound up with the Laboratory that it is almost impossible to speak of the one without mentioning the other, the office of secretary having been held by some member of the Laboratory staff since their inauguration.

THE ROTHAMSTED ALLOTMENT CLUB.

These allotments, with the attached club, are reputed to be, if not the oldest, one of the oldest of their kind in England, the main portion of the gardens being laid out in 1852, additional land being added some few years later.

The Club House was built in 1857, Sir John's object in building it being, as he himself has stated, to add to the comfort and enjoyment of the labourers, his idea of a Club House being (as in this case) a large room wherein the men could have their beer and tobacco, with a smaller room attached to be used as a committee room, reading room, or employed as a store.

The first secretary, so far as I can gather, was the man "Dudgeon," mentioned in the early part of my narrative, he being followed by G. Knott, whilst for the last thirty-one years I myself have held the office.

Here at this Club House quite a centre of activity was soon established, and various have been the side clubs and societies started in connection with it. It should be here mentioned that at this time the members of the club were nearly all labourers employed on the Rothamsted and neighbouring farms; to-day very few indeed of the allotment holders are *bona-fide* agricultural labourers.

I find in looking over some old papers relating to the club which I came across in the Laboratory, that amongst these societies were what was called "The Harpenden Labourers' Store Society"

(being a kind of Co-operative Stores), a Flour Club (most of the cottage women at that time baked their own bread), a Pig Club (many of the labourers at this time keeping a pig or pigs), a Coal Club, and another society bearing the ugly name of "The Death Fund," the object of this last being to assure to the relatives a certain sum of money on the death of a member or member's wife.

I understood that whenever any special branch club or society was formed, Sir John himself would attend at the Club House and explain to the assembled members the working of the same, also advising as to methods of proceeding.

I was also told that it was at one of the meetings in connection with the Pig Club that Sir John, on his attendance at the Club House, was accompanied by the late "Sir Charles Dickens," who soon afterwards wrote an amusing article describing his visit, the same appearing in the first number of *All the Year Round*, April, 1859, under the title of "The Poor Man and his Beer."

Prizes were also given by Sir John for best gardens, and every now and again a vegetable show was held in the Club Room also.

Of these various societies one only, namely, the "Death Fund," is in existence to-day.

I well recollect at the time—when I was a grass-picker boy—people quite often used to call at the Laboratory to see Knott concerning the allotments, he being at that time secretary and kept his account books, etc., in the furnace room, where he did his nitrogen work. King would answer their knock at the back door, and upon being asked for Knott would say, you will find him in that room, indicating the front Laboratory, and then leave them to find their own way into the room.

On most of these occasions we would notice the door leading from the back Laboratory slowly open, a man's head would appear in the opening, and then a voice exclaim, "Is Muster Knott in?" It was curious that these men callers seldom knocked at this middle door or opened it and came into the room, but would nearly always (as we used to say) poke their heads in and then ask the question.

If Knott was in, he saw the man, but if away, Mr. Willis would ask what he wanted and, being one of the Allotment Committee members, would jot down particulars and give them to Knott when he returned. "I wanted to see 'im about a bit o' garden," probably the man would say. "I 'eard 'em say as 'ow there's some a-gooing"; or, perhaps, he had "brought a load of dung for old so and so, and wanted to know which was his bit of ground," and so on.

Occasionally the caller has been a woman. She would never open this middle door, but would knock until someone went to her. Her business generally was explained something like this, "I've brought my man's rent, or quarter (meaning the quarterly club subscription), he forgot it, or he was ill, or something or other

on Saturday, so I thought I'd bring it over, it's no use a trusting to 'im, for 'e'd only let it goo and run on."

Sir Henry would sometimes be in consultation with "Knott" when people have called about allotment matters, but he (Sir Henry) always allowed him to attend to them, resuming consultation when they had gone.

At 11 o'clock each morning a quarter of an hour or so was allotted for "beaver" time, those of the staff who were allotment holders being allowed, if they wished, to go to the Club House close at hand for their "beaver" beer.

When Knott left the Laboratory he also gave up the allotment secretaryship, and, as before stated, I was appointed in his place. At the same time he handed over to me two books, one being the Allotment Accounts Book, and the other book containing the minutes of the Committee meetings.

In looking over this minute book I was much amused at some of the queer entries recorded during the earlier years.

I found that the maximum fine imposed on a member in any case was the sum of 5s. There are several cases recorded where the Committee had decided to fine so and so, this maximum fine for causing disturbances at various feast times. Another place records the fact that the wife of a certain member shall be fined 5s. for cutting George Smith's cauliflowers; and yet another recorded minute, wherein after serious discussion it was resolved that a man named Attwood be fined 5s. for calling the Committee "An ignorant set of fools."

The affairs of the club were managed by a Committee of twelve members elected annually. They were nicknamed "The Twelve Apostles" at one of the early Committee meetings noted in the minute book. I found the names of all the Committee members recorded as present, but I looked in vain for any account of the business transacted, the only item recorded on that night being, "The Committee had a Leg of Mutton Supper."

But THE day of the Allotment Club was that of the Annual Dinner, this event, as before stated, always taking place on the first Saturday in June.

Old members have told me that for the first few years the dinner was held in the Club House itself, but as the number of members increased the club room became too small for the occasion, and so a large frame tent was hired each year and erected in the Laboratory grounds, and here henceforth these annual proceedings were held, being always spoken of as the Club Feast.

This Feast Day was a great day at the Laboratory also. Now and again the joints have been brought here on the afternoon of the day previous, being placed on a long bench in the back Laboratory, and then we had, of course, to go, see, and admire, Sir Henry also, if he happened to be in the Laboratory, being one amongst us. Early next morning they were despatched, those for

boiling to the large coppers in the brewhouse of River's Lodge, close by (kindly placed, year after year, at the service of the Committee by T. Wilson, Esq.), and the other joints for roasting to the neighbouring bakehouses. And they were joints too, the like of which were seldom seen, save on these Feast days, the largest and most admired being the round of salt beef, the gift of Sir John, as president of the club, a similar joint being given by him each year. This huge round weighed generally 94 to 96 lbs. I don't think I ever knew one weigh less than 90 lbs.

Sir John always presided over the dinner, carving this joint himself, a special set of carvers being sent from Rothamsted for his use. Once only in my time do I remember him being absent through illness.

The task of lifting this huge round of beef out of the boiling water of the copper was always a rather ticklish one, two well-cleaned garden forks being used for the purpose. I recollect what sighs of relief went up when it was safely accomplished, and the meat, resting on its special dish, was carried into the tent on the Laboratory hand-barrow, or wheeled in on our platform barrow and safely deposited in its appointed place on Sir John's table.

In addition to this, another smaller round of salt beef was provided of about 40 lbs. in weight, together with four large legs of pork, two of which had been salted for boiling, the other two being fresh for roasting; also there were four large legs of mutton, besides two or three other joints the gift of friends.

There were also ten or twelve large peas puddings, twelve tins of potatoes (these being baked under the joints), ten loaves of bread, two barrels of beer and, in later years, one or two cases of mineral waters for the newer teetotal members.

Two meals were provided—dinner about 2.30 and supper about 7.30.

No sweets of any sort nor cheese were added to the menu, which has continued the same the whole length of years.

Generally about 140 members attended the Feast, they paying one shilling each towards expenses.

On these Feast Day mornings there was generally a great bustle going on in the back Laboratory; we in the front could hear the rattle of baking-tins and the clinking of crockery, as dishes, etc., were being handed about. I, with a boy's inquisitiveness, would manage, under some pretence, to get out the back every now and again to see how things were progressing.

At 12 o'clock Mr. Willis, Knott, King, and any of the farm men who might happen to be at the Laboratory took their departure. They were going, they said, to spruce themselves up for the great occasion. King, who lived close by, was soon spruced, and quickly back again at the Laboratory in time to see to the locking of the front door, etc., at 1 o'clock, at which time, being Saturday, we

all left. I noticed that King was not so smart on these days as when he was dressed for the races.

Before going home I was able to have a good look round. I found by this time the front of the tent had been decorated with large bunches of flowers and evergreen, the long tables were laid, pepper boxes, salt cellars, and mustard pots being grouped in threes on various parts of the tables; pint pots had also been placed, one for each person. For many years the drinking vessels used at the Club House were what was called "Japanned Tin Pots," and these were always used at the Club Feasts. Later on earthenware pint pots, initialed R.A.C., were substituted. At the present time these also have been discarded, quite up-to-date standard pint and half-pint glasses now being used. Members attending had to bring their own plates, also knives and forks, and one could see many of the old members wending their way across the common with plate, knife and fork, generally tied up in a red handkerchief and tucked under the arm. Some of these old members arrived and took their places in the tent long before the appointed hour. Doubtless they came thus early so that they could enjoy the excitement and bustle attendant on the setting out of the feast. I have spoken of pint pots as being used for drinking vessels. Before the war it was an almost unheard of thing for a member to call for half-a-pint of beer, he was considered a poor weak fellow who could not manage to drink a pint; but then beer was only 1½d. a pint, now that it is sixpence half-pints are frequently in demand.

Other carvers beside Sir John were the rector and the curate of the parish, also some of the local gentry. The members of the Committee attending to the wants of members.

At the finish of the dinner the business meeting came on, over which Sir John, as president of the club, presided, the Secretary read his yearly report, and the election of Committee for the ensuing year took place.

In early years I understood that often a clean sweep was made of the "Twelve Apostles," another twelve being elected; probably the next Feast Day they would be served in like manner to their predecessors. (Nowadays the Committee are elected for three years, so many retiring annually, these can be re-nominated for re-election if they wish.) After this business meeting came two speeches, first by the Rector, and the other by Sir John. These speeches were eagerly looked forward to, and for many days after one could hear items of the speech being discussed in the Club House and also by the labourers in the fields.

These proceedings being over, the visitors took their departure, the members passing the rest of the day in quiet enjoyment.

Occasionally at those early Feast Days music was provided, so I am told, two men named the Mac-Georgies, with violin and harp, being in attendance.

Arriving at the required age, I applied for an allotment, and

in due course became an allotment holder, a member of the Club, and I went to the yearly Feasts. When I was appointed Secretary the whole supervision of the festival was entrusted to me. By this time I knew pretty well how to proceed with the preparations, because, as stated previously, the menu never varied.

At the death of Sir John the presidency devolved upon his son, the late Sir Charles Lawes-Wittewronge, who also took the greatest interest in the Club and its affairs. He also continued the annual gift of the gigantic round of salt beef.

At Sir Charles' death, Sir John's grandson, Capt. W. Lancelot Creyke, took over the presidency, taking the same interest in the Club and continuing the annual gift as his illustrious kinsmen before him until the great war came on and D.O.R.A. put an end to all feastings and such like.

Some few years ago an old labourer named Charles Luck, whilst at the dinner imparted the fact that it was his fiftieth consecutive Club Feast dinner. He said he had not missed once for the whole fifty years. The news was at once communicated to Mr. Creyke, who at that time was president and, as such, was presiding over the gathering.

Mr. Creyke was very interested, and he gave Luck a sovereign as a gift to mark the occasion. Mr. Campbell, one of the research workers at the Laboratory, who was present at the feast, got the old chap to pose for his photograph. This Mr. Campbell enlarged and gave it to him also as a memento.

As the Laboratories extended, the space whereon the tent had been yearly erected was now required for other purposes. It was then erected year by year on some vacant ground near the Club House, and here from thence onwards the proceedings were held.

There has also been one or two other days famous in the annals of the Club, the most talked of and longest remembered being the occasion of the marriage of Sir John's only daughter to Walter Pennington Creyke, Esq. To celebrate this event, Sir John arranged for the whole of the allotment holders, together with their wives, to be taken on an excursion, per the Midland Railway, to the Crystal Palace.

One can quite understand that in this (at that time) quiet little agricultural village the announcement of the proposed trip caused no end of talk and excitement. Many of the allotment holders had never been on a railway train, and more still had never travelled so far from home.

Some of the old members (all of whom have now passed away) have often told me of the great doings (as they called it) of that wonderful day.

From them I learned that Sir John caused dinner and tea to be provided for the party at the Palace, and, further, that a small sum of money should be given to each person to spend whilst there. They have told me how amused the waiters were at their country

talk. I myself have laughed many times over their account of this great event in their life's history.

With regard to the dinner itself, beside the usual meats, there were many varieties of sweet dishes, jellies, blancmanges and other delicacies, many of which they knew not the names. One man when asking the waiter for another helping of sweet, said, "I don't know the name on it, but it's that shivery, shakey tackle." One old allotment holder named John Pearce (keeper of the paths and roads) vowed that if there was another "excus'ion he blowed if he wouldn't goo ag'in;" whilst another old chap said he would like for the Squire's daughter to get married every year.

Another memorable event in its history was that of the fireworks display given on the occasion of the Jubilee of the Rothamsted Experimental Station in the year 1893.

In commemoration of this Jubilee, Sir John also proposed sending the allotment holders and their wives on an excursion to the Crystal Palace to witness one of the famous fireworks display often given there by well-known firms; and he proposed that the excursion should be run in the evening. Years had passed since the first excursion to the Palace, and by this time many of the allotment holders and their wives had become well advanced in years. They said they would much like to see a display, but they were rather afraid of the late hours that would be entailed by the excursion, and so they hesitated before accepting. Sir John, however, decided that as they could not go to the display, the fireworks should be brought to them, and he arranged for a very fine display to be given on a certain night in one of the meadows belonging to "Welcome," just opposite the Laboratory.

The news of the coming event was soon noised abroad, so that on the appointed night a large crowd from the surrounding countryside, besides allotment holders and other villagers, assembled on the common, from whence everyone could easily get a fine view of the proceedings.

It was in the little glass-house belonging to these allotments that final and conclusive experiments on the fixation of free nitrogen of the air in the growth of leguminous plants were conducted by Sir John Lawes and Sir Henry Gilbert in 1888, 1889 and 1890.

This glass-house was built for the use of the allotment holders, wherein they might raise seedlings and plants for their gardens, and the wives could also force along their flowers; but the place had fallen on evil times, had been in disuse for some years past, having become rather dilapidated. However, application was made to the Committee by Sir Henry for permission to use it for experimental work, and upon the request being granted the place was thoroughly cleaned down, renovated, and put in order; strips of finely perforated zinc were fixed over the inner side of all ventilators, a precaution taken to exclude as far as possible any inquisitive insects injurious to plants or otherwise; a long trestle

table was placed up the centre of the house, and new sun-blinds were fixed on the outside. Everything was now in order, and so this little glass-house entered on its new lease of life, and in it were conducted the experiments referred to, the results and fame of which are well known throughout the world of agricultural science.

Specially made tall glazed earthenware pots were used for the experiments, which were mostly conducted in sets of four, each set growing one sort of leguminous plant.

Three pots of each set were filled with white sand which had been previously well washed and afterwards thoroughly ignited, so that it was completely sterilized ; to this sand (when cold) was added a little plant ash, the same being well mixed with it before potting up, each of the first three pots of each set receiving the same weight of sand, whilst the fourth was filled with rich garden soil. The pots were then taken to the glass-house, placed upon the trestle table, and the seeds planted, care being taken that the seeds were all of uniform size and weight, and also that each variety was planted at same depth.

After planting the first pots were left as they were without any other addition, the fourth pots which contained the garden soil were also left as they were, but to the second and third pots were added a little watery extract. This extract was obtained by using a little of the garden soil as in pots four, stirring it about in some specially distilled water. After stirring for a time, the whole was allowed to stand by a bit until the sediment had settled, and then a little of this watery extract, which I was told contained microbes, was poured upon No. 2 and No. 3 pots, this process being called by Sir Henry, Microbe Seeding.

The pots were then left in the glass-house; they were watered every now and again with specially distilled water, we having to keep a record of the amount used for each pot at every watering.

The key of the place was kept in the Laboratory ; it was hung on a nail at the side of my large balance, and I can fancy now I hear Sir Henry saying to Mr. Willis, " Just get the glass-house key, Mr. Willis, we will go and examine the pots." And so they used to go, almost daily, noting minutely the progress in growth and development of the plants or any other matter concerning them during the course of the experiments.

I well remember all the preparations and the attention we paid to all details connected with the growth of the plants throughout.

Very often I was called upon to accompany Sir Henry to the glass-house, and more often did I go with Mr. Willis at noting and watering time. Of course, I knew a little about bacteria, etc., but I had never heard so much about the subject as I did at this period.

I was assured that if the watery extract applied to the pots acted as was anticipated there would be a very noticeable difference in the growth of the plants in those pots so treated ; that the

microbes contained in the extract were of a beneficial nature, and although in all probability they would attack the roots of the plants and form warts or nodules thereon, the bacteria contained in these nodules had the power to fix the free nitrogen of the air to the great benefit of the plants themselves, and I was also told that the object of these experiments was to ascertain or prove if this assumption was correct or otherwise ; and so I watched with great interest the development of the plants. As they grew we soon saw a remarkable difference between those in the microbe-seeded pots and those in the pots where no extract had been applied.

But of all the series carried out I was most interested in that of 1889. I recollect that in this year there were more sets of pots than the previous year, each, of course, growing plants of the leguminous family ; four of the sets were annuals, the others being legumes of longer life. Of these sets again those of the annuals I thought the most interesting. They were Beans, Peas, Vetches and Yellow Lupins. The first three sets were treated as before-mentioned, the difference in the lupin set being that instead of rich garden soil the extract wherewith Pots 2 and 3 of this set were "Microbe Seeded" was obtained from soil which was known to be good soil for lupin growth, coming, I believe, from Lincolnshire, the fourth pot being filled also with some of this soil. In the very early stage of the plants' growth we could easily detect a difference which as the progress toward maturity proceeded became very remarkable ; those in the first pot of each set, where no extract had been given (after using up the food stored in the seed) remained stunted, inactive and weakly looking, whilst those growing in Pots 2 and 3 (microbe seeded with the small quantity of watery extract) soon began to go ahead, the pea and vetch plants climbing up the supports provided until they reached the highest point in the ridge of the roof, they even out-grew the plants in No. 4 pots, containing similar soil from which the extract was obtained, the reason for this, it was assumed, being on account of somewhat deficient aeration in these soil pots, caused probably by slight waterlogging.

The Lupin set was, to my thinking, a very beautiful experiment. No. 1 Pot, poor weakly plants, with pale yellowish looking leaves ; Pots 2 and 3, large, green, wide-spreading healthy-looking leaves, the plants also bearing some splendid spikes of flowers, and, as I have said, surpassing in growth the plants in No. 4 Pot.

With regard to the Bean set, notwithstanding the precautions taken to keep out insects, the bean aphis found their way in and attacked these plants ; consequently they grew but little.

At the appointed time all the plants were removed from the pots, sand and soil being gradually washed away by means of a water jet directed on to the bulk of sand or soil, the plant being carefully withdrawn as soon as the roots were freed.

The plants in the No. 1 pots had developed but little root and had no nodule formation, whilst Pots 2 and 3 had a large amount of root growth and plenty of nodules formed on the roots. No. 4 pot also contained much root growth, with a very considerable formation of nodules, but they were, as a rule, much less in size than those of the second and third pots.

Seeing that these plants could not be disturbed for root examination, another series of experiments for that object were started in the Laboratory grounds in small pits or boxes, with fronts and backs of movable slates, they also being in sets of fours, one behind the other, some pits being filled with sand and others with soil.

These were called the Pit Experiments, the plants being taken up at different stages of growth to examine and note how far the increase of growth was connected with the development of the root nodules.

The allotment glass-house is no longer used by the Laboratory workers, much larger and more commodious houses, with modern improvements, being built for their work within the Laboratory grounds. But even now I am occasionally asked by visitors if they could be shown the actual glass-house wherein these noted experiments were carried out.

Only this last summer (1921) one visitor from over-seas asked to be shown the place, and upon my taking him to it, asked again if he would be allowed to take a photograph of it. Upon being told that he could, he at once took the photo. The place is, and was then, in a very ruinous condition. I only hoped that this photo, like most other photos of people and places, would flatter a bit, and not show up the defects of the old place too much.

People no longer come to the Laboratory on allotment club matters, all the old customs and associations connecting the two are now severed, save that I myself as Allotment Secretary still link up with the past.

Through all the chances and changes of the fleeting years the old club has stood firm, and to-day it stands on as sound a financial footing as ever it did.

In finally concluding these memoirs, I have to thank first Dr. Russell, who has very kindly afforded me the time and opportunity to write them up, which amount of time has been very considerable, seeing I had no diary or notes to assist me, having to trust almost entirely to memory, so that possibly there may be names and incidents I have missed; also my thanks are due to Mr. B. A. Keen, who so very kindly made the excellent drawings which illustrate the early part of my narrative.

I trust that the reminiscences have afforded you interest and pleasure. I myself, whilst writing, have derived much pleasure, as during the compiling of them I have lived again in the scenes of my boyhood, youth and early manhood, the old Laboratory,

with its quaint old times and customs, and all the old familiar faces rising most vividly before me. The newer and more up-to-date Laboratories that have arisen, together with the host of young people, research workers and others who have passed through right up to the present time, have afforded most happy associations. All these pleasant memories, I trust, will abide with me until my life's end.

THE END.

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